UNIVERSITY OF ALASKA

Alaska Agricultural Experiment Station

DON L. IRWIN, Director

in cooperation with the

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH ADMINISTRATION

ADMINISTRATIVE

REPORT OF PROGRESS

January 1 to December 31, 1951

PALMER ALASKA

ALASKA AGRICULTURAL EXPERIMENT STATION

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PREFACE

This booklet is a compilation of annual administrative reports required of the Alaska Agricultural Experiment Station, a public supported research institution. Shown here is a complete outline of research problems under study during the year just ended. Objectives, financial support, accomplishments during 1951 and lines of approach to be emphasized during the next crop season are all set forth in detail. Also indicated is the intricate cooperation established with allied agencies, perfected in an effort to eliminate overlapping in adjacent areas of interest. Staff assignments are presented in order to fix responsibilities and to give credit where due. A brief discussion of the physical plant is also included to show what progress has been made in the building program, now some three years old, and to point out certain housekeeping problems that, in the public interest must be solved in the near future.

Because these questions concerning the needs, progress, and accomplishments of the Alaska Experiment Station are of interest to all persons, agencies and legislators concerned with Alaska's welfare, this administrative report has been distributed rather widely. It is hoped by this means to account for expenditures of public funds and to furnish a guide for future planning.

This report is not intended for general distribution. As has been customary in the past it will be followed by an interpretative publication in more popularized language for widespread distribution both within and without the Territory. From time to time, these annual reports are supplemented by technical bulletins, circulars, processed publications and news releases, each concerned with a specific subject. This procedure is in accord with our recognized policy of transmitting practical research results to those who will benefit from such specialized knowledge. For this purpose the experiment station maintains a close working relationship with such action agencies as the Alaska Extension Service, the Soil Conservation Service, on-the-farm training programs and other groups and individuals with educational functions.

DON L. IRWIN
Director

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ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

WORK PROJECT NUMBER: AL-1-1

DIVISION: Alaska Agricultural Experiment Station

BUREAU OR AGENCY: Agricultural Research Administration

WORK PROJECT TITLE: Soil Classification, Mapping and Management Research

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: Allan H. Mick

LOCATION: Alaska Agricultural Experiment Station, Palmer, Alaska

COOPERATION: Soil Conservation Service (participated in mapping); Agronomy Department (participated in forage fertilizer studies); Animal Husbandry Department (participated in forage studies); Horticulture Department (participated in potato studies); Anchorage Potato Chip Company (participated in potato quality studies).

OBJECTIVE OF CURRENT WORK: To classify and inventory soil resourses in the Matanuska and Tanana Valleys, and in selected sites on the Kenai Peninsula (Homer, Kenai, Fritz Creek, Ninilchik); to develop or adopt rapid analytical techniques for anticipating nutrient amendments for soils; to investigate fundamental physical and chemical characteristics of Alaskan soils; to investigate the field response of forage, grains and potatoes to fertilizer amendments, including minor elements.

PROGRESS DURING THE YEAR: Soil classification and mapping (AL-1-1-1, 2-1-3) was restricted to collating, analyzing and interpreting data collected in previous seasons. Over 1,200 samples were analyzed in the "rapid testing" program (AL-1-1-4), with emphasis on correlation of test results with actual crop responses in an effort to develop prediction techniques. Organic matter levels of important soils were determined (AL-1-1-5), and preliminary work was started on assessing physical characteristics of importance in irrigation planning (AL-1-1-6). Studies of fertilizer requirements for small grains were continued under the soil science project (AL-1-1-7) which is to be integrated with AL-1-6-5 during the coming crop season. Studies dealing with bromegrass (AL-1-1-8) were expanded to include estimates of phosphate and potash interactions, analysis of last year's data of harvesting trial, the influence of high nitrogen applications, and second-year utilization of fertilizers; a factorial field trial also provided a means of measuring the response of native "hayflat" vegetation to fertilizers. The study of how manganese deficiencies limits oat yields (AL-1-1-9) was integrated with the minor element work (AL-1-1-10), and expanded to include wheat, rye and barley at three sites. Pot-testing (AL-1-1-11) was held in abeyance pending completion of adequate greenhouse facilities.

In cooperation with the Horticulture department (AL-1-2-7), studies of potato nutrition were expanded; they included a factorial design to reveal nitrogen and potash interactions, and a 3^4 lattice in 9 replications to compare 64 combinations of nitrogen, phosphate and potash levels in the Tanana Valley.

Also initiated this year was a cooperative study of the nutritional requirements of onions and red table beets in a randomized design at five locations in the Matanuska Valley.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: A method of increasing forage yields has reduced the land requirements of livestock and dairy enterprises. Soil surveys yield information concernining economic land utilization and the feasability of extending research results into unsettled areas.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Soil surveys to include preparation of maps will be continued in:

The Matanuska Valley (AL-1-1-1)
The Tanana Valley (AL-1-1-2)
Elsewhere in Alaska as the opportunity arises (AL-1-1-3)

Development of rapid analytical techniques will be stressed (AL-1-1-4) Supplemented by pot-testing (AL-1-1-11) as facilities become available. Laboratory investigations into the chemical (AL-1-1-5) and physical (AL-1-1-6) characteristics of important soil series will be expanded; field plot studies dealing with the nutritional requirements of forage (AL-1-3-11), potatoes (AL-1-2-7), and grains (AL-1-6-5) will be expanded to the limit of land and labor at hand. Field studies of responses to minor elements (AL-1-1-10), will be continued.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-1-1 (F)

PROJECT TITLE: Soil Classification and Mapping in the Matanuska Valley

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: Allan H. Mick (Paul Martin, Neil Michaelson)

LOCATION: Palmer, Alaska

COOPERATION: Soil Conservation Service, United States Geological Survey

OBJECTIVE OF WORK: To complete a survey and make maps available which summarize the distribution features of a soil classification based on proved criteria. These maps will serve as a basis for study, and for devising and recommending suitable land use management practices.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Extension of survey into areas not yet under cultivation, with particular stress on the Wasilla-Pittman area where recent road construction has opened large acreages of previously inacessible land.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: This survey is basic to other Experiment Station projects. It has revealed that: (a) Important agricultural enterprises in the Matanuska Valley are chiefly supported by 2 mineral series, Knik and Bodenburg. (b) Successful farm enterprises are supported by deep phases of these 2 series; shallow phases support part-time enterprises and constitute a major portion of land now available for homesteading, and for expansion of agriculture within the valley. (c) Because of drainage problems, organic soils remain marginal in character. Drainage problems are acute to the extent of eliminating the use of organic soils until local demand for produce makes exploitation economically feasible. (d) In all probability, the results of technical studies on the important mineral soils are interchangeable in application.

Indirect benefits to local agricultural enterprises have thus accrued from this work insofar as the results of studies undertaken in other agronomic projects have been extended in the form of specific recommendations concerning fertilizer practices, crop adaptations, and related information.

PROGRESS DURING THE YEAR: Field work was held in abeyance this year because of the necessity of diverting all efforts to other lines of enquiry. Existing field sheets were collated and analyzed, and the necessary preliminary work for the 1952 season has been completed. A review of recent United States Geological Survey literature and unpublished studies of this area has shed considerable light on the nature of land forms and parent materials in the Pittman-Wasilla-Big Lake area. Photo reconnaissance studies show that some information can be extended into the Susitna Basin region which adjoins the Matanuska area at an arbitrary line of demarcation along the 150° meridian.

This juncture is now tentatively thought to be an interlobate morainic area, marking the confluence of the Susitna and Matanuska valley glaciers. Because it escaped reworking by glacial streams, substrata materials are generally

heterogeneous tills. Surface forms are modified by numerous small linear ridges with a local relief seldom exceeding 10 feet. Some sorting has occured adjacent to these ridges, resulting in minor deltoid gravelly and sandy fans. Surface textures are medium sand loams with moderately developed structural attributes. Fairly well developed podzolized profiles are conspicuous on well-drained surfaces. Elsewhere characteristic members of a complete drainage catena may be recognized. A few scattered terraces exhibit degraded ground water podzol profiles.

PUBLICATIONS: Preparation of maps, except in preliminary form and limited number, is not justified at the present time. Evidence obtained from this project made possible the publication of Circular 13, revised, concerning fertilizer recommendations. Several inter-agency reports were also produced.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-1-2 (F)

PROJECT TITLE: Soil Classification and Mapping in the Tanana Valley

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: Allan H. Mick (Paul Martin, Neil Michaelson)

LOCATION: Palmer, Alaska

COOPERATION: Soil Conservation Service

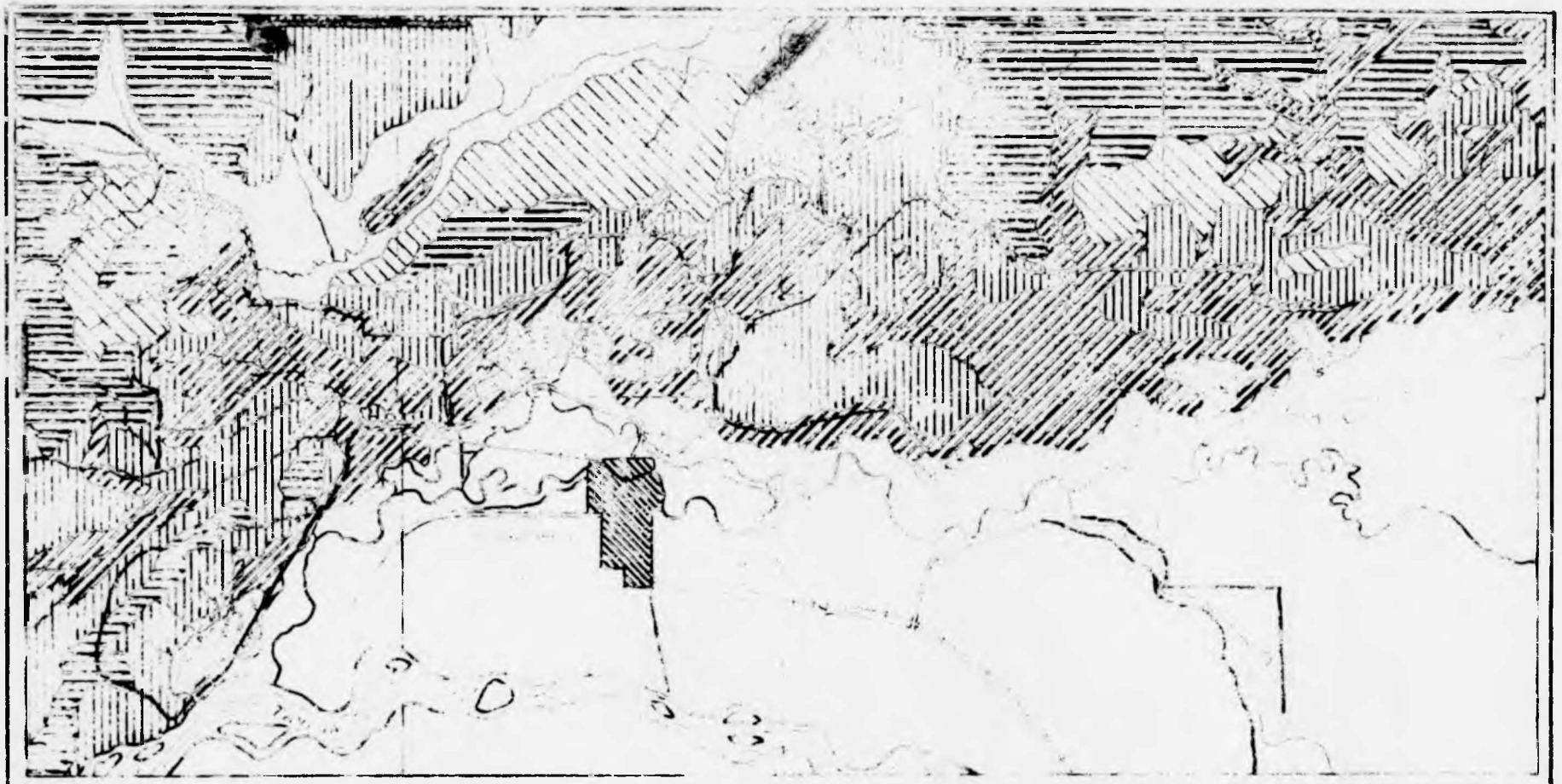
OBJECTIVE OF WORK: To complete a survey and make maps available which summarize the distribution features of a soil classification based on proved criteria. These maps will serve as a basis for study, and for devising and recommending suitable land use management practices.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Collecting field notes and assembling data into maps. Field work will be held to a minimum, consisting mostly of reconnaissance studies in areas adjacent to those already mapped.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: This survey is basic to other Experiment Station projects. It has revealed fundamental relationships determined by the geographic distribution of potential agricultural sites in the Tanana Valley. The classification makes possible an intelligent application and extension of the agronomic research results. Indirect benefits to local enterprises have thus accrued from this work, insofar as the results of studies undertaken in other agronomic projects have been extended and applied in the form of specific recommendations concerning fertilizer practices and related information.

PROGRESS DURING THE YEAR: Over 7,100 acres were surveyed under this project. Field notes completed in 1950 were interpreted in terms of the national classification system and preliminary work on a soil map was completed. A land classification map has been assembled (see next page) covering the entire Fairbanks Soil Conservation District.

PUBLICATIONS: Evidence obtained from this project made possible the publication of Circular 13, revised, concerning fertilizer practices.



Gilmore series, chiefly residual

Fairbanks series, loessial

Fairbanks-Gilmore association

Organic soils, muck and peat

Chatanika-Salcha association, loessial

Chena-Tanana association, alluvial

Scale in miles 0 1 2 3 4 5

Alaska Agricultural Experiment Station 1951

Sketch map of the Fairbanks Soil Conservation Subdistrict
showing the
PRINCIPAL SOIL SERIES AND ASSOCIATIONS

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-1-3 (F)

PROJECT TITLE: Soil Classification and Mapping in Alaska Exclusive of the Matanuska and Tanana Valleys

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: Allan H. Mick (Neil Michaelson)

LOCATION: Palmer, Alaska

COOPERATION: None

OBJECTIVE OF WORK: To classify soils in Alaska, exclusive of the Tanana and Matanuska Valleys, preparatory to organizing soil categories under the national system of classification.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Continuation of studies when and where an opportunity is presented. This work will be accomplished in conjunction with travel for administration or other purposes; or in conjunction with other agency projects.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Indirect benefits to local agricultural enterprises have accrued from this work insofar as the results of studies undertaken in other agronomic projects have been extended and applied in the form of specific recommendations concerning fertilizer practices, crop adaptation, and related information.

PROGRESS DURING THE YEAR: Map and photo reconnaissance, supplemented by observations of technicians traveling along the railbelt, resulted in a revision of the soil potentials in the Susitna Basin. This basin is bounded in the west by Mt Susitna and Peters Hills, on the east by the Talkeetna range and meridian 150°. To the south it opens on Cook Inlet. The basin is roughly oval in shape with its long axis extending some 90 miles north and south; its east-west width averages 30 miles. An arm extends westward from the main basin to a distance of 25 or 30 miles up the Yentna and Skwentna valleys. The total land area below an elevation of 500 feet is roughly 3,000 square miles.

In any estimate of agricultural potential climate must receive as much consideration as soil characteristics. Limited meteorological studies show the growing season in this area to be relatively short - somewhere within the range of 78 to 90 days. Rainfall is somewhat greater than in the Matanuska region. Comparable climates elsewhere in the world have never supported much more than a bare subsistence for farm populations. Agricultural development of the Susitna Basin under existing economic conditions is therefore unlikely. When economic and population pressures become great enough to justify expansion of Alaska's agriculture outside of the present focal regions, it still will remain a matter of some conjecture as to the desireability of developing the Susitna Basin.

The limiting factor in the development of this region is therefore anticipated to be deficiencies in climate rather than in soils. Considerable areas of good soil may be found in the Susitna Basin. A rough classification includes 3 land categories, briefly described as follows:

1 High benches and mountain slopes, a large proportion of which are steep, rough and broken. Small acreages suitable for cultivation are scattered and disconnected. Grazing is the most intensive use to which a large acreage can be put, and even this grazing land will not be used unless winter feed can be grown elsewhere in the basin. Most of the land in this category will be left in forest.

2 Low benches, rolling glaciated land forms, and elevated terraces and plains. These areas are linear in nature, following the river courses and separating large areas of undrained land. A major part of the cultivable land falls in this category.

3 Low undrained plains (tundra, muskeg, marshes and swamps) make up the largest contiguous areas which accupy the center of the basin. Within this land class are inclusions of rolling hills and elevated land that may be broken and farmed. When population pressures warrant extensive drainage operations, some of the present wet soils may be cultivated.

Estimate of potential agricultural land in the Susitna Basin, without regard to climatic limitations

Land category(a)	Percent of total	POTENTIAL FARMLAND(b) Extensive use(c)	Intensive use(d)	GRAZING LAND(e)	TOTAL
		Thousands of acres			
High benches....	21	82	94	48	408
Low benches.....	45	348	410	201	872
Undrained plains	34	19	96	173	640
Total.....		449	600	422	1,920(f)
		Percent of land category			
High benches....		20	23	12	
Low benches.....		32	41	23	
Undrained plains		3	15	27	
Total.....		23	31	22	

(a) As described on p 11
(b) Land that can be tilled. Climatic limitations may prohibit its use.
(c) Land that can be immediately cleared and tilled with out reclamation practices.
(d) Includes acreages listed in the column on the left plus additional acres that can be cultivated after drainage.
(e) Summer range areas exclusive of acreages listed in the columns on the left; can be used only if supplementary winter feed is produced within the basin.
(f) Total area of basin west of 150° and below elevation of 500 feet.

PUBLICATIONS: Limited to interdepartmental and inter-agency reports. All evidence indicates that information in Circular 13, revised, (dealing with fertilizer recommendations) can be extended to these areas.

PROJECT NUMBER AND FUND: AL-1-1-4 (H)

PROJECT TITLE: Soil Fertility Levels as Indicated by Rapid Soil Analysis

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: Allan H. Mick (Paul Martin, Margaret Blom)

LOCATION: Palmer, Alaska

COOPERATION: Extension Service and Soil Conservation Service

OBJECTIVE OF WORK: To adapt recognized rapid analytical techniques to Alaskan soils in an effort to develop a method of predicting nutrient deficiencies under field and greenhouse conditions.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Field fertilizer trials with small grains, forage, potatoes, and vegetables on representative soil series will again provide an opportunity to correlate actual yields with values obtained from rapid analysis of carefully selected soil samples. Nitrogen, phosphate, potash, calcium and magnesium levels are to be studied. Samples from the entire Territory will again be solicited from farmers and gardners to obtain a broad concept of fertility characteristics.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Because of widespread popular misunderstanding and a lack of application of soil testing, the value of soil test information is exaggerated. Some Alaskan farmers send soil samples to commercial laboratories in the States and follow recommendations that do not agree with experience or research results obtained in Alaska. A local soil testing program is urgently needed, not only to supply information concerning proper soil management practices but to correct misunderstandings that have resulted from an over-extension of experience accumulated in other climates.

PROGRESS DURING THE YEAR: Completion of adequate laboratory facilities in late 1950 permitting expansion of the soil testing program during the year just ended. The procedure as finally adapted to the conditions at hand is briefly summarized as follows:

1. Receiving and preparation of samples included drying, crushing, screening and packaging, recording on storage containers appropriate identification and pertinent information.

2. Extracting with 10 percent sodium acetate in 3 percent acetic acid (buffered at pH 4.8) in the presence of a clarifying agent (activated charcoal). After shaking for 30 minutes, the extract is separated by filtering and divided into the necessary aliquots by automatic pipettes.

3. Colorimetric analyses are employed following routine patterns established for each nutrient and in the presence of all others, no separations being made. Comparison standards are developed for each series of 20 to 30 samples processed simultaneously.

4. Reactions are measured by means of a standard glass electrode pH meter, using a 1:2 soil-water paste.

During the reporting period 1,273 samples were processed representing 33 areas widely distributed throughout the Terrirory. Included in this total were samples received from 137 cooperators, to whom all results were returned with interpretive recommendations. Some 516 samples were analyzed only for reaction, nitrates, phosphates, and potash; in addition to these four characteristics, 757 samples were analyzed for calcium, iron, magnesium, manganese, aluminum, copper and ammonia content. These studies involved a total of 8,668 determinations excluding approximately 5,000 determinations executed in the process of working out procedural patterns and in standardizing reagents and equipment. For calculating correlations with plot yields the following numbers of samples were studied:

Bromegrass plots	322
Potato and vegetable plots	171
Grain plots	126
TOTAL	619

As in former years, attempts at correlating soil nutrient levels revealed by rapid analysis on random samples proved disappointing. Although some correlation between soil phosphate levels and plot yields was observed, no significant correlation obtained between actual yields and nitrogen or potash levels. Despite this lack of correlation between nutrient levels and measured yields, field observations during the growing season indicate that the analytical procedures should not be discarded as worthless. Experience elsewhere shows that many factors other than soil nutrient levels influence plant growth; here in Alaska soil temperatures and light conditions certainly exert a profound effect on plant nutrition. It is therefore naive to expect a high degree of relationship between crop responses and any single growth factor. Another fallacy underlying interpretations of soil tests is the sampling technique which may introduce so strong a bias as to observe the interactions in question. On the whole, however, agricultural producers and action agencies display a much higher degree of confidence in test procedures than appears warrented by mathmatical indices.

Sufficient data is now at hand to justify a tentative nutritional classification of Alaska's soils, which is summarized below.

Category	Number of Samples (1)	pH (2)	POUNDS PER ACRE, MEDIAN VALUES, OF — NO_3	P_2O_5	K_2O	Ca	Fe	Mg	Mn	Al	NH_4	Cu
Dark-colored												
Virgin....	26	5.8	1	113	350	12,000	20	*	10	30	25	55
Cultivated	44	6.3	1	38	250	3,000	10	50	10	10	15	25
Light-colored												
Virgin....	37	5.3	1	63	150	3,000	20	50	30	50	5	45
Cultivated	38	6.3	1	113	150	3,000	10	150	10	30	5	15
Organic soils	12	5.3	1	138	150	5,000	10	150	10	30	15	15
Garden soils	40	5.8	7	88	250	3,000	10	150	10	50	15	15

(1) Number of samples compared is limited because of the necessity of selecting those with comparable characteristics.
(2) Median pH values.
(*) No true median for these magnesium values exists because of a double-noded distribution curve.

Tentative conclusions drawn from these comparisons are as follows:

1. Dark-colored soils are relatively high in potash while light-colored soils are low in potash.

2. Samples selected from undisturbed sites representing potential plow layers are generally more acid than comparable fields under cultivation. This difference is attributed to differences in organic characteristics and associated microbiological activities.

3. As the pH raises during cultivation, nutrient levels decrease.

4. Garden soils are generally characterized by higher nitrogen levels, probably a result of intensive management practices.

5. The inherent fertility of most agricultural soils is not high, a common attribute of soils developed under humid conditions.

Based on field observations and plot responses a tentative classification of nutrient levels has been devised for average Alaskan soil conditions. Interpretations are listed in the following table, in terms of pounds per acre.

Nutrient	Low	Moderate	Medium	High
Nitrate nitrogen ...	0-20	21-40	41-80	Over 81
Phosphate	0-80	81-160	161-320	Over 321
Potash	0-100	101-200	201-400	Over 401
Calcium	0-1000	1001-2000	2001-4000	Over 4001
Magnesium	0-20	21-40	41-80	Over 81
Iron	0-10	11-20	21-40	Over 41
Manganese	0-15	16-30	31-60	Over 61
Aluminum	0-20	21-40	41-80*	Over 81*
Ammonium nitrogen ..	0-10	11-20	21-40	Over 41
Copper	0-15	16-30	31-60	Over 61

*Probably exceeds tolerance of most crop plants

PUBLICATIONS: Information accumulated in this project has been intergrated with field trial results. The results, in terms of specific fertilizer recommendations for important Alaska crops, have been published as Circular 13, revised, "General Recommendations, Fertilizers for Alaska, 1952".

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROJECT REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-1-5 (F)

PROJECT TITLE: Fundamental Chemical Characteristics of Alaskan Soils

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: Allan H. Mick (Neil Michaelson)

LOCATION: Palmer, Alaska

COOPERATION: Soil Conservation Service

OBJECTIVE OF WORK: To describe Alaskan soil categories in terms of base exchange characteristics and other agriculturally significant chemical properties.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Depends on laboratory facilities and technical assistance. If conditions are favorable, base exchange studies will be initiated.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Estimates of organic matter levels in Alaskan soils and soil materials have facilitated the assessment of their productivity characteristics.

PROGRESS DURING THE YEAR: A total of 105 samples were analyzed for organic matter content, estimated as total combustible materials. Because only small quantities of free carbonates and hydrated minerals were present in these samples, total combustible material is considered a good index of organic matter levels. Studies of two soil series from the Tanana Valley revealed that the organic matter content of a virgin Fairbanks profile ranged from a maximum of 49 per cent (of oven-dry weight) in the A_{oo} horizon to a minimum of 2 per cent at a depth of 24 inches in the subsoil. Distribution within the profile resembled that of podzolized soils. In adjacent cultivated fields the organic matter content varied from 8 to 10 percent on the plow layer.

The average organic content of a postulated plow layer from a wooded site in the Chatanika series was 41 percent as compared to 10.4 percent in an adjacent well-managed cultivated field under production for at least 15 years. A neighboring newly broken field contained an average of only 4.6 percent organic matter.

Comparisons of some 40 samples from cultivated fields in the Matanuska-Chugiak-Anchorage area disclosed no significant difference in organic matter content between "light-colored" and "dark-colored" categories. The so-called "dark-colored" soils (Knik and Bodenburg series) in the Matanuska Valley are apparently dark because of their dark colored mineral constructions. This evidence amplifies last year's conclusions from Project AL-1-1-6 studies.

PUBLICATIONS: Limited to interagency reports.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-1-6 (F)

PROJECT TITLE: Fundamental Physical Characteristics of Alaskan Soils

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: Allan H. Mick (Neil Michaelson)

LOCATION: Palmer, Alaska COOPERATION: Soil Conservation Service

OBJECTIVE OF WORK: To find a solution to problems of low soil temperatures and low moisture supplies during the growing season.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Physical analysis of representative samples of agricultural soil series and analogous undisturbed profiles to discover fundamental pore size and particle size distributions; permeability, and moisture and aeration relationships; changes brought about in these characteristics by clearing and management practices and measures to increase yields and preserve the soil as a natural resource.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Low soil temperatures, impeded drainage caused by peculiar pore size distributions and persistant frost, and low moisture retaining capacities are several factors that limit yields in many Alaskan soils. Except for particle size analysis of samples collected by Bennett and Rice in 1913 and a few samples studied by Rockie in 1950, no work has been done in this field. Opportunities for public assistance are great, especially in devising good management practices.

Field Moisture Study Absorption units (After the method of Bouyoucos and Mick, described in Michigan Agricultural Experiment Station Technical Bulletin 172, 1940), were installed in early spring in a truck field to be sprinkler irrigated. Correlated as Bodenburg fine sandy loam, this field is characterized by a complete lack of structural development. Previous experience indicated that transmission of moisture from subsoil to the surface 2 inches was not sufficiently rapid to insure satisfactory germination or early growth of such shallow planted crops as carrots and onions. In addition, severe winds during dry spring weather usually are a hazard on this single-grained soil which is extremely susceptible to rapid surface drying and wind erosion.

Sprinkler irrigation was observed to decrease surface drying and the erosion menace by firming the seedbed. Germination and early growth of both carrots and onions was also encouraged. Periodic measurements of soil moisture at a depth of 6 and 18 inches by means of the obsorption units disclosed that:

1. The moisture characteristics of this soil resemble those of a silt loam.
2. Even during extremely dry periods immediately preceding irrigation, when moisture tension in the surface 1 inch approached a maximum, tensions at 6- and 18-inch depths remained at a minimum.
3. Throughout the growing season subsoil moisture tensions remained at initial minimum levels. Slight responses at the 6-inch level were noted following precipitation, either as irrigation or natural rainfall. These responses were not of sufficient magnitude to exceed changes that might be caused by temperature variations.

It is concluded that at this site adequate moisture supplies are present in subsoil materials. This moisture cannot be used by shallow rooted crops because it does not move upward in response to tension differentials. A practical method of increasing the moisture supplying capabilities of the plow layer is

to pack it immediately before or after seeding. In addition to sprinkler irrigation, an alternative is increase the organic content and thereby promote structural development in this soil.

Physical Attributes of Selected Profiles Moisture equivalents for some 175 samples were measured by an adaptation of the centrifuge technique (see Public Roads, 12:204-205, 1931). Values for representative plow layers from several different sites are listed below.

Site	Sample description	Organic content	Moisture equivalent
		Percent*	Percent*
Tanana Valley.....	Gilmore Series, cultivated field	3.1	12.4
	Fairbanks series, cultivated field	3.8	11.5
	Chatanika series, virgin (spruce)	21.6	27.7
	Salcha series, virgin (aspen)	48.8	57.5
	Tanana series, cultivated field	7.8	25.4
	Minto series, virgin (aspen)	50.6	49.9
Chugiak.....	Anchorage series, cultivated	8.3	17.4
	Knik series, cultivated	13.0	38.1
	Unclassified, organic (muck)	38.0	65.0
Kenai Peninsula...	Unclassified, dark grassland	11.4	29.0
	Unclassified, light woodland	9.5	27.5
Matanuska Valley..	Bodenburg series, cultivated	8.4	28.0
	Knik series, cultivated	7.9	29.5

*Based on oven-dry soil weight

Significant in these comparisons are the relatively high moisture equivalents. Since none of these samples contained over 8 percent clay, their high moisture retaining characteristics are attributed to peculiar pore-sizes, associated either with a highly micaceous mineral content, or with a high proportion of silt and a lack of structure.

Permeability indices In conjunction with classification studies in the Tanana Valley, a few samples were exhaustively analyzed as to physical characteristics. Values for several are listed below, illustrating typical indices for these and related soil series in this particular area.

Silt loam samples from --	Volume components			Volume weight	Specific gravity	Permeability index	Organic matter
	Porespace		Soil				
	Other	Capillary					
	Percent			Gms/ml		K**	Percent
Fairbanks							
A_1	23.5	49.0	27.4	1.20	2.61	8.9	9.6
A_2	11.4	46.2	42.4	1.30	2.68	6.4	2.8
C	2.3	49.7	49.0	1.40	2.74	0.4	1.1
Chatanika							
Virgin.....	6.3	49.8	43.9	1.20	2.66	2.0	4.1
New field....	11.0	46.5	42.5	1.10	2.71	4.0	4.6
Old field....	9.0	60.1	32.1	0.80	2.57	2.0	10.4

*Average of 2 or more samples

**Which expresses the rate of flow of water through the sample in inches per hour.

PUBLICATIONS: Limited to interagency reports.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-1-7 (F)

PROJECT TITLE: Fertilizers for Small Grains

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: A. H. Mick, S. C. Litzenberger

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: Agronomy Department

OBJECTIVE OF WORK: To study the responses of cereal grains to nutrients added in the form of concentrated carriers. Responses are to be judged by yields and quality.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Work under this project is to be transferred to AL-1-6-5 (P) revised 12/28/51, during the 1952 crop season. It is proposed that Soil Science Department personnel will conduct all studies dealing with cereal crop nutrition. Included in these studies will be field plot designs to compare the effect of:

Various levels of nitrogen, phosphate and potash
Various sources of nitrogen and phosphate
Differences in nutritional requirements of cereals growing on different soils

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: All evidence indicates that not only yields of cereal grain but also its quality can be improved by proper use of fertilizers. Work on this project was held to a minimum during the reporting period.

PROGRESS DURING THE YEAR: In addition to the randomized trials conducted at the Matanuska and Fairbanks Experiment Stations (see report of the Agronomy Department. AL-1-6-5), observation of variety trials on new and old fields throughout the Territory show that site conditions determine the fertilizer requirements of cereals. Cereals growing on newly cleared fields required large quantities of nitrogen and phosphate.

PUBLICATIONS: Information was incorporated in Circular 13, revised, dealing with fertilizer recommendations.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-1-8 (F)

PROJECT TITLE: Fertilizers for Forage Crops

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: Allan H. Mick, H. J. Hodgson

LOCATION: Matanuska Experiment Station

COOPERATION: Agronomy Department

OBJECTIVE OF WORK: To investigate the influence of nutrients added in the form of concentrated carriers on yields, winter survival, and chemical composition of forage crops; to determine the effect of various fertilizer ratios on the botanical composition of grass-legume associations; and to measure the effect of rates and date of application on the seasonal production of forage.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: In order to coordinate these studies with related investigations of cultural practices, this project will be terminated and the work will continue under AL-1-3-11 (P), revised 12/28/51. Continuation of work started in 1949 with bromegrass and bromegrass-legume mixtures, and the winter-survival of alsike clover. Heavy applications of nitrogen will be made on bromegrass to discover the point of diminishing returns. Interaction studies of phosphate and potash on the yields of bromegrass will also be continued.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS PROJECT: Fertilization of bromegrass has yielded profitable returns in both wet and dry seasons. With good management, pasture and hay yields can be increased 7- or 8-fold. By using fertilizers, farmers can grow protein more economically than they can buy it. As a result of this work, bromegrass for hay, silage and improved pastures is assuming an important role in Alaska's agriculture.

PROGRESS DURING THE YEAR: Promising results were again obtained with bromegrass which is well-adapted to the Matanuska Valley environment. Bromegrass responds well to fertilizers in both wet and dry seasons. Other phases of this work included evaluation of the winter-survival of alsike clover, observations of carry-over effects of sulfur on clover, and the response of hayflat sedges to fertilizer applications.

Third-year response of bromegrass to fertilizers Field plots established in 1949 and fertilized both in that year and in 1950 were again treated according to original plans. Only two clippings were obtained from the simulated pasture series, all midsummer growth being lost to marauding cattle that grazed experimental plots in preference to the surrounding grass. When harvested, quadrat clippings were weighed green, then dried, and dry weights obtained. Statistical studies of yield data again revealed significant increases with successive additions of phosphate and potash; the difference between no application and medium applications was, however, much greater than between the medium and high applications. Responses to additional increments of nitrogen were again linear in nature, up to and including the largest application of 128 pounds of available nitrogen per acre. Dry matter obtained from hay was considerably greater

TREATMENT Pounds/A	DRY MATTER YIELDS Tons/A	
	Pasture	Hay
Nitrogen	Means of 12 plots	
0	0.30	0.54
16	0.34	0.84
32	0.51	0.99
32 & 32	0.81	1.46
64	0.73	1.64
64 & 64	1.16	2.04
128	1.07	2.48
L S D at -		
5%	0.15	0.37
1%	0.19	0.49
Phosphate & potash	Means of 28 plots	
0 - 0	0.46	0.84
40 - 20	0.80	1.55
80 - 40	0.85	1.89
L S D at -		
5%	0.04	0.16
1%	0.06	0.25

ANALYSIS OF VARIANCE

Source	DF	Mean squares	
Replication	3	20	76**
Phosphate & potash	2	12,240**	805**
Error a	6	40	6
Nitrogen	6	13,730**	571**
N x P x K	12	1,450**	51**
Error b	54	110	14

*Split application, in early spring and midsummer

**Significant at the 1% level

Role of phosphate and potash in bromegrass nutrition A 3³ factorial compared three levels of nitrogen, phosphate and potash in two replications, yields being clipped twice to simulate pasturing. (a third clipping was lost to marauding cattle). Statistical analysis of dry matter yields disclosed the responses set forth in the table at the right.

Bromegrass at this particular site responds more to phosphate than to potash fertilization; applications of more than 40 pounds of potash per acre do not appear justified. A significant interaction between nitrogen and phosphate results from great responses of one in the presence of the other; for practical purposes, neither nutrient should be applied alone to bromegrass.

(Con't from page 23) than from pasture with due allowance for grazing losses from the latter. Significant interactions (see table at the left) between nitrogen and phosphate-and-potash show that bromegrass responds better to nitrogen in the presence of the other two nutrients than when applied alone. Although split nitrogen applications did not greatly influence total yields, they did extend the active growing period throughout the summer.

Samples from all plot yields have been retained and will be analyzed for crude protein. The results will be included in next year's report.

TREATMENT Pounds/acre	DRY MATTER YIELD***
Nitrogen	Tons/acre
60	1.36
60 & 60	1.52
120	1.53
Phosphate	
0	0.78
40	1.62
80	2.02
Potash	
0	1.31
40	1.51
80	1.59
L S D at -	
5%	0.14
1%	0.18

ANALYSIS OF VARIANCE

Source	DF	Mean squares
Total	53	
Replication	1	0.36**
Treatment	26	0.63**
Nitrogen	2	0.38**
Phosphate	2	7.23**
Potash	2	0.17*
N x P	4	0.10*
N x K	4	0.01
P x K	4	0.07
N x P x K	8	0.02
Error	26	0.03

*Significant at the 5% level

**Significant at the 1% level

***Means of 18 plots for 2 out of 3 clippings.

Response of Bromegrass to high nitrogen applications Because of the linear response of bromegrass to nitrogen obtained in previous studies, a 3 x 2^2 factorial was laid out in 1950 to explore the influence of heavy nitrogen applications. Under the conditions of limited moisture prevailing in that season, no yield difference were reported. Subsequent chemical analysis of samples retained from this experiment disclosed that all yields contained extremely large quantities of crude protein ranging from a minimum of 14.8 percent to a maximum of 26.6 percent. Despite low dry matter yields, acre yields of crude protein were relatively high.

TREATMENT : Pounds/A	DRY MATTER YIELD*	PROTEIN CONTENT** (Quality)	
Nitrogen..	T/acre	%	Lbs/acre
50 & 50..	1.26	18.9	489
100....	1.26	22.2	564
100 & 100.	1.37	20.1	548
200....	1.09	20.9	451
200 & 200.	1.28	22.9	581
400....	1.15	24.1	546

*Means of 12 plots **Of dry matter

Nitrogen carry-over The high nitrogen experiment described immediately above was abandoned at the end of the 1950 season because of a fundamental fallacy in the field layout. In 1951 these plots were uniformly fertilized as part of the original hayfield. By early June, however, the entire field design was conspicuous, indicating a carry-over effect worth studying. Quadrats were therefore harvested on June 29 and the yield data analyzed, revealing the following results.

TREATMENT : Pounds/acre	DRY MATTER YIELD***
Nitrogen	Tons/acre
50 & 50	0.58
100	0.59
100 & 100 . . .	0.87
200	0.82
200 & 200 . . .	1.10
400	1.05
L S D at -	
5%	0.18
1%	0.24

ANALYSIS OF VARIANCE

Source	DF	Mean squares
Total	71	
Replications . .	2	0.13
Blocks	3	0.16*
Treatments . . .	23	0.14**
Nitrogen . . .	5	11.86**
Phosphate . .	1	1.20
Potash	1	0.00
Error	43	0.05

*Significant at the 1 percent level
**Significant at the 5 percent level
***Mean values for 12 plots

No significant residual effect was traced to either phosphate or potash. The large carry over effects of nitrogen are attributed to an extremely dry season in 1950 in which moisture deficiencies prevented full utilization of applied fertilizers. The magnitude of these second-year responses to nitrogen imply that losses due to ammonification and leaching, usually considered large in more humid regions, are minimized by low soil temperatures and rainfall in Alaska. Note that as much carry-over resulted from single applications as from split treatments.

When should bromegrass be harvested? During the reporting period a statistical analysis was completed of data collected in the previous year from a bromegrass uniformity field trial. The object of this study was to determine the best time to harvest heavily fertilized bromegrass. A uniform sod was treated with 128 pounds of nitrogen, 80 pounds of phosphate, and 40 pounds of potash per acre in mid-April. Quadrats were harvested in quadruplicate at weekly periods beginning May 28. Data for selected dates are shown on the next page.

Yields and quality of bromegrass at selected dates as related to stage of maturity, Matanuska Station, 1950. Values are means of four plot yields.

DATE HARVESTED	DRY MATTER YIELD		PROTEIN CONTENT (Quality)		APPEARANCE	
	Percent	Tons/acre	Percent*	Lbs/acre	Height Inches	Vegetative stage
May 28.....	23	0.44	27.4	237	6	2 or 3 leaves only
June 12 ...	22	0.74	22.1	324	14	Heads emerging
June 26 ...	27	1.43	13.7	394	24	Panicles unfolding
July 10 ...	34	1.74	12.2	426	32	Panicles ½ unfolded
July 24 ...	39	1.96	9.8	388	33	Stamens gone
Aug 7 ...	40	2.05	10.2	414	32	Leaf spot appears
Aug 28 ...	61	2.39	5.4	259	32	All foliage yellow
Sept 4 ...	52	1.75	5.4	188	32	Leaves shattered
Oct 16 ...	28	1.32	3.8	103	32	cured but damp
L S D at -						
5%		0.26	2.8	74		
1%		0.35	3.8	100		

This study illustrates the inverse relationship between increasing yields and protein content. Maximum yields of highest quality forage were obtained in early July about the time that internode lengthening ceased and when yellow stamens were conspicuous in about a tenth of the heads. Although tonnage yields continued to increase thereafter until the end of August, the protein content (and quality) of the resulting forage rapidly fell off. Analysis of variance disclosed that these measurements were made on essentially uniform plots, no significant differences being found between replications or strata.

Fertilizing native "hayflats" A 3^3 factorial in four replications compared the response of native "hayflat" vegetation (chiefly Carex sp. harvested for winter livestock forage) to three levels each of nitrogen, phosphate and potash. On July 10, 45 square foot quadrats were harvested with a power mower. Analysis of yield data disclosed these results.

TREATMENT Pounds/acre	DRY MATTER YIELD*
Nitrogen	Tons/acre
0	0.64
40	0.91
80	1.05
Phosphate	
0	0.87
40	0.85
80	0.89
Potash	
0	0.85
30	0.87
60	0.88
L S D at 1% . .	0.10

ANALYSIS OF VARIANCE		
Source	DF	Mean squares
Total	107	
Replications. .	3	0.14**
Treatments . .	26	0.13**
Nitrogen . .	2	1.58**
Phosphate . .	2	0.01
Potash . . .	2	0.01
N x P	4	0.02
N x K	4	0.01
K x P	4	0.02
N x P x K . .	8	0.01
Error	78	0.02

*Means of 36 plots
**Significant at the 1% level

Responses to nitrogen were readily visable throughout the growing season as a dark green color. Recovery on nitrogen treated plots was more rapid than elsewhere. Carex failed to respond to phosphate and potash at this side; an explanation is found in the origin of these tidal flat soil materials and the fact that they are covered with tide water once or twice each year.

PUBLICATIONS: Results were integrated in Circular 13, revised, dealing with fertilizer recommendations. A technical publication and a paper for presentation at a professional meeting are planned. Results have been publicized through the Extension Service, the Soil Conservation Service and other educational groups.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-1-9 terminated June 5, 1951

PROJECT TITLE: The Response of Oats to Manganese Applied in Fertilizers

PERIOD COVERED BY THE REPORT: January 1 to June 5, 1951

SUPERVISORY LEADERS: Allan H. Mick (Neil Michaelson)

LOCATION: Matanuska Experiment Station, Matanuska Valley

COOPERATION: None

OBJECTIVE OF WORK: To discover how the quality and yields of oats grown on Alaskan soils of different fertility levels are influenced by applications of manganese carriers.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Work will be continued under AL-1-1-10 (T), revised 1951 to include a survey of varieties grown on various sites and conditions. Not all varieties are equally susceptible to manganese deficiency. Two new varieties recently introduced will be tested to determine their susceptibility to manganese deficiencies.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Deficiency symptoms of Climax oats were alleviated and yields increased by applications of 100 pounds of manganese sulfate. Project terminated in 1951.

PROGRESS DURING THE YEAR: See Project AL-1-1-10 (T), revised 1951.

PUBLICATIONS: None

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-1-10 (T), revised 1951

PROJECT TITLE: Minor Elements

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: Allan H. Mick, W. M. Laughlin

LOCATIONS: Matanuska and Tanana Valleys

COOPERATION: None

OBJECTIVE OF WORK: To discover the response of crops to treatments involving minor elements.

LINES OF WORK TO RECEIVER SPECIAL ATTENTION DURING THE COMING YEAR: Response of certain "indicator" crops (celery, carrots, onions and cauliflower) to treatments of copper, boron and zinc. Basic treatment of N, P_2O_5, K_2O and manganese will insure that these nutrients do not limit growth. The influence of manganese on grains will receive continued attention.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: In the United States, Canada and in parts of Europe, minor elements have limited production of important crops. Applications of small quantities of minor element fertilizer materials have proved profitable. In view of the nature of Alaskan soils, particularly with regard to their alkaline characteristics, minor elements may prove effective in increasing yields and in improving quality. Minor elements may be expected to assume more conspicuous roles as farming practices become more intense.

PROGRESS DURING THE YEAR: A factorial experiment compared the response of oats (4 varieties), barley, wheat, and rye to manganese sulfate applied in fertilizers. Two replications were planted in 3 localities. All plots were uniformly treated with 30 pounds of nitrogen, 80 pounds of phosphate, and 12.5 pounds of potash per acre. Statistical analysis of yield data showed that manganese treatments did not influence grain and straw yields or grain quality, despite the appearance of deficiency symptoms in oats at all three localities. These deficiency symptoms were most severe in Vicland oats; Golden Rain and Climax oats exhibited deficiency symptoms at only one site (Irwin-Albrecht farm). See next page for analysis of variance.

PUBLICATIONS: Information contributed to Circular 13, revised, dealing with fertilizer recommendations.

Response of grain to manganese, Matanuska Valley, 1951

Comparison	YIELDS Total*	Grain	TEST WEIGHT
Grain & Variety	T/acre	Bu/acre	Lbs/bu
	Means of 18 plots		
Golden Rain oats	3.40	107.4	41.9
Climax oats	3.58	111.1	41.6
Vicland oats	2.55	84.2	38.6
Gopher oats	3.30	105.6	40.7
Edda barley	3.71	86.0	49.3
Khogot wheat	3.41	47.4	60.0
Prolific rye	4.15	34.2	54.8
Least significant difference at -			
5 percent	0.29	10.8	1.2
1 percent	0.39	14.3	1.5
Location	Means of 42 plots		
Martin	3.43	86.1	48.1
Irwin - Albrecht	2.73	64.9	46.0
Bradley	4.16	95.7	46.0
Least significant difference at -			
5 percent	0.19	7.1	0.8
1 percent	0.25	9.4	1.0

Source	DF	ANALYSIS OF VARIANCE Mean squares		
Replication	1	0.19	102	0.6
Manganese	2	0.12	11	0.6
Grain	6	4.21**	16665**	1205.0**
Location	2	21.57**	1046**	64.6**
Mn x Grain	12	0.13	125	1.0
Mn x Loc.	4	0.19	40	0.5
Grain x Loc.	12	0.47**	1050**	11.7**
Mn x Grain x Loc	24	1.12	126	0.9
Error	62	0.14	111	1.4

*Total dry matter including both grain and straw
**Significant at the 1 percent level

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-1-11 (F)

PROJECT TITLE: Soil Fertility Levels as Indicated by Pot-testing Techniques

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: W. M. Laughlin

LOCATION: Matanuska Experiment Station

COOPERATION: None

OBJECTIVE OF WORK: To develop a method of predicting nutrient deficiencies in Alaskan soils and to determine if and what inherent deficiencies exist in important agricultural sites and soils.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: If greenhouse facilities become available, this technique will be applied to representative soils from several agricultural sites.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: In certain western states, pot-testing techniques yield better prediction information than rapid chemical tests. Prediction information from pot-testing will be extremely useful in Alaska.

PROGRESS DURING THE YEAR: Work under this project was held in abeyance pending completion of new greenhouse facilities in Palmer. Pots and other equipment have been obtained and it is hoped that factorial studies may be initiated in March 1952.

PUBLICATIONS: None

WORK PROJECT NUMBER: AL-1-2

DIVISION: Alaska Agricultural Experiment Station

BUREAU OR AGENCY: Agricultural Research Administration

WORK PROJECT TITLE: Horticultural Crop Investigation

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: M. F. Babb, C. H. Dearborn, Arvo Kallio

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: Division of Fruit and Vegetable Crops and Diseases (participated in tests of potatoes, lettuce and small fruit varieties); United States Forest Service (participated in tests of ornamentals); several state experiment stations (participated in potato and small fruit breeding); several commercial companies (participated in weed control work related to potato and vegetable culture); Agricultural Engineering Department (participated in potato culture and vegetable forcing projects); Soil Science Department (participated in potato and vegetable culture projects); several farmers (cooperated in potato variety tests).

OBJECTIVE OF CURRENT WORK: (1) Potato breeding for an earlier maturing, higher yielding, disease resistant variety for Alaska. (2) Potato cultural investigations involving fertilization, weed control, top killing, planting distances and storage methods. (3) Vegetable cultural investigations involving a study of the effects of pelleting seed, direct seeding versus transplanting for certain crops and nutritional requirements of such crops as beets and onions. (4) Winter forcing of vegetables. (5) Testing of ornamentals for adaptation and hardiness. (6) Tree and small fruit testing for hardiness and the breeding of small fruits. (7) Vegetable variety testing to secure better adapted varieties and crops for Alaska.

PROGRESS DURING THE YEAR: AL-1-2-4(R) Superior selections and varieties from the 1950 potato variety tests were planted at the Matanuska and Fairbanks Stations for further evaluation. Cooperative tests of 13 selections and 7 commercial varieties with farmers in the Matanuska Valley again demonstrated the superior qualities of our selection 57.44-3-46 and it has been increased for release to growers in 1952. AL-1-2-7(P) Seven chemicals were used as sprays for weed control in potatoes. Of these "Premerge" gave excellent weed control with no apparent deleterious effects on yield or internal appearance of the tubers. Continued studies of the influence of differential fertilization on the cooking quality of naturally "good" and naturally "poor" potato varieties indicated that their inherent qualities can be measurably altered by fertilization. AL-1-2-8(T) Pelleted seeds of cabbage, carrots, lettuce and radish were planted in comparison with non-pelleted seeds to determine if the particular pelleting compound used would delay germination sufficiently to permit chemical weed control before germination of the vegetable seed. However, the effect of pelleting on germination was not clear cut. In the case of cabbage only 10 percent of the pelleted seeds germinated as compared to 50 percent of the non-pelleted. Carrots and radish showed a slight trend toward better germination from normal seed, whereas pelleted lettuce seed tended to give better germination from the pelleted seed. In a comparison of transplanted versus direct seeded cabbage, approximately 50 percent of the transplants of both

Midseason Market and Oakview Ballhead made marketable heads as compared to 18 percent for Midseason Market and only 5 percent for Oakview Ballhead from direct seeding. In an attempt to determine the nutritional requirements of red beets and onions, a factorial experiment was conducted at 5 locations in the Matanuska Valley. This year's results indicated that maximum yields of both crops can be obtained at the highest levels of nitrogen, phosphate and potash employed (100 pounds of nitrogen, 300 pounds of phosphate and 50 pounds of potash per acre). AL-1-2-9(F) Lack of funds for the construction of a suitable forcing structure limited work on this line project during the past year to the propagation of forcing stocks of rhubarb and asparagus. AL-1-2-10(F) Except for the care and propagation of stocks of ornamentals already on hand, work on this project has been and will be held to a minimum during the present emergency. AL-1-2-11(F) Some additional potentially hardy varieties of tree fruits were added to the list of those under test at the Matanuska Station and a start was made toward establishing a test planting at the Fairbanks Station. AL-1-2-12(F) The winter of 1950-51 proved to be a test period for practically all types of small fruits and as a result it was learned that none of the 28 commercial varieties of strawberries under test at the Matanuska Station was hardy. However, of the "Sitka Hybrids" 10 varieties survived and plans have been made for using them in the strawberry breeding program in which they will be crossed with some of the more promising commercial varieties. AL-1-2-13(F) Due to lack of adequate greenhouse facilities, work on this project was held in abeyance during the past year. AL-1-2-14(F) Representative varieties of lettuce, cabbage and broccoli were placed under systematic tests at the Matanuska Station. This was the second year of the lettuce variety test and by repeating its outstanding performance it seems probable that the U.S.D.A. selection No. 3310 may be named and introduced as a variety especially well adapted to Alaskan conditions.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: The potato breeding program has resulted in the finding of a selection (No. 57.44-3-46) which not only equals or exceeds any commercial variety in yields, but is far superior to them in size and shape of tubers, shallowness of eyes and freedom from skin feathering. It also compares favorably with all but the very best commercial varieties in quality. Foundation stock of this selection has been increased and it is now planned to release it to the public as a named variety through the Alaska Certified Seed Growers Association.

Lettuce variety tests have demonstrated that a U.S.D.A. selection (No. 3310) is equal to any of the present day commercial varieties in yield and exceeds them in long standing ability, size and shape of head and resistance to damage from handling during harvesting and marketing operations. Consideration is now being given to the naming and introduction of it to growers as a variety especially well adapted for culture in the Matanuska Valley of Alaska.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Special attention will be given to potato breeding AL-1-2-4(R); to fertilization, spacing studies and weed control in potatoes AL-1-2-7(P); to nutritional studies, planting practices and weed control in the more important truck crops AL-1-2-8 (T); to the maintenance and propagation of stocks of ornamentals already on hand AL-1-2-10(F); to the collection and propagation of tree fruits for Alaska AL-1-2-11(F); to the testing and breeding of small fruits, especially strawberries, raspberries and blueberries AL-1-2-12(F); and to vegetable variety testing and breeding, especially with lettuce, cabbage, broccoli, beans, turnips and carrots AL-1-2-14(F).

PROJECT NUMBER AND FUND: AL-1-2-4(R)

PROJECT TITLE: (Revised) Potato Breeding

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: C. H. Dearborn, Arvo Kallio and M. F. Babb

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: State Experiment Stations and Individual Foundation Stock Seed Growers

OBJECTIVE OF WORK: To select or breed one or more potato varieties better adapted to Alaskan growing conditions than Arctic Seedling in the following respects: 1. Higher yield of U. S. number 1 tubers to the acre. 2. Earlier maturity of tuber with attractive skin that shows a minimum of bruising and "feathering" at digging. 3. Very shallow eye and stolon cavity which will markedly reduce losses in culinary preparation. 4. Smaller vine type to facilitate in the digging operation. 5. Tuber and vine resistance to physiological and pathological diseases affecting potatoes in the Territory.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: 1. The potato selection number 57.44-3-46 will be increased this season, named, and placed in the channel for distribution to growers. 2. Distribution of number 57.44-3-46 for trial throughout Alaska and the States to determine its adaptability. 3. Crossing of higher quality, tougher skin seedlings with more productive commercial varieties chosen from the variety yield trials of the past 3 years. 4. Continuation of seedling and variety yield trials to select a good early maturing variety and a higher quality late variety. 5. Cooperative potato variety and seedling trials with farmers in the potential agricultural areas of the Territory. 6. Screening test of all potato varieties and lines for resistance to ring rot. 7. Screening test of all potato varieties and lines for resistance or immunity to scab or other skin blemishes resulting from soil environment. 8. Effect of photoperiod and temperature in modifying tuber and plant characteristics.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: The farmers and homesteaders in the Matanuska and Tanana Valleys have benefited directly from this project in that they can be advised regarding the merits or faults of newly named varieties as well as many varieties well adapted to other regions but not necessarily adapted here.

PROGRESS DURING THE YEAR: The selections and varieties of potatoes from the 1950 trials that showed better than average quality were planted at Matanuska and at Fairbanks in 4 replicates well randomized. At Matanuska the material was separated into a group for early harvest and a group for late harvest, while at Fairbanks the test was designed for late harvest. The early harvest experiment totaled 75 varieties (10 commercial and 65 numbered selections) and was planted by machine May 20. The late harvest at Matanuska consisted of 52 varieties (19 commercial and 33 numbered seedlings) planted by machine May 23 while at Fairbanks the planting was made up of 18 commercial varieties and 22 numbered seedlings.

Although the data have not been statistically analyzed, it seems apparent that selection number 57.44-3-46 is the outstanding high yielding, shallow eye, smooth skin potato as it has been in the past. This numbered selection performed similarly in yield and appearance at six locations in the Matanuska Valley in cooperative grower trials. In each case it was the growers choice among 13 numbered selections and 7 commercial varieties including Arctic Seedling. Variety 57.44-3-46 was a good appearing potato at Fairbanks but was not considered to be as outstanding as in the Matanuska area. On the basis of its past performance it was anticipated that seedling 57.44-3-46 would be in demand by the growers so it was increased for foundation stock in 1951. Approximately 50 bushels or 1.5 tons are on hand for further increase in 1952.

The cost of weeding was materially reduced by applying a complete cover spray of Premerge or Dow General contact weed killers just before the potato sprouts broke ground. Premerge had a residual toxic effect on chickweed and lambsquarters and eliminated all weed growth for 4 to 6 weeks except volunteer grains. No cultivation or hoeing was necessary during the entire season.

Breeding lines were increased by adding 29 numbered selections from Minnesota and the following named varieties: Canoga, Saranac, Satapa, Smooth Rural and Waseca.

PUBLICATIONS: It is planned to publish the results of the 1948, 1949, 1950 and 1951 potato variety tests at an early date.

PROJECT NUMBER AND FUND: AL-1-2-7 (P)

PROJECT TITLE: Potato Culture and Storage Investigations

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: M. F. Babb, C. H. Dearborn, A. Kallio, A. H. Mick, W. M. Laughlin, C. I. Branton

LOCATION: Fairbanks and Matanuska Experiment Station

COOPERATION: Chemicals for weed control and top killing studies were made available by: American Cyanamid Co., San Franscisco, California; American Chemical Paint Co., Ambler Pennsylvania; Atlas Powder Co., Wilmington, Delaware; Carbide and Carbon Chemical Corp., Yonkers, N. Y.; Dow Chemical Co., Midland, Michigan; E. I. DuPont de Nemours, Wilmington, Delaware; Naugatuck, Connecticut. Soil Science Department and Anchorage Potato Chip Co. cooperated in the nutritional studies. Lambert brothers (farmers on the Kenai peninsula) cooperated in minor element study.

OBJECTIVE OF WORK: (1) To determine which chemicals will control chickweed and lambsquarters in potatoes and the effect of such chemicals on yield and quality; (2) to determine the effect of chemical and physical destruction of potato tops on potato yield and quality (See AL-1-4-1); (3) to determine the optimum planting distance between seed pieces of Variety 57.44-3-46 for maximum yield and the influence on yield of 4 rates of fertilizer used in conjunction with spacing; (4) to investigate the influence of various ratios of nitrogen, phosphorus and potash on potato yields and quality; and (5) to determine the effect of different storage methods on potato quality.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Studies on chemical weed control, top killing, spacing distance versus rate of fertilization, and the nutritional requirements of several varieties will be continued.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Successful chemical weeding tests have aroused great interest among all growers and has resulted in many coming to the Station to get suggestions on how to construct their own tractor mounted weed control sprayer. On the basis of our first hand knowledge of weed killers, merchandizing organizations were advised on what chemicals to stock and consequently materials were made available to the growers for the first time. All chemicals stocked were purchased promptly by farmers and applied with very gratifying results. Chemical weed control will be recommended for potatoes in 1952 in view of the fact that pre-emergance weed killing has proved satisfactory here as well as in the States. On the basis of the seed-piece spacing versus fertilizer-rates test, growers can be better advised on the proper cultural methods to use in producing the new Variety 57.44-3-46, as yet unnamed. Nutritional studies have encouraged the use of more efficient and profitable fertilizer practices.

PROGRESS DURING THE YEAR: Results of these several lines of approach to the various problems encountered in potato culture and storage are reported separately in the following sections.

Chemical weed control Seven chemicals were used as sprays before potato sprout emergence and on the shoulder of the hill immediately after hilling; these were "Premerge", Maleic hydrazide, sodium pentachlorophenate, dichloral urea, Crag 1,

CMU and Dow General. The test consisted of 4 replicates of 27 combinations including a check or unsprayed treatment. "Premerge" used as a pre-emergence spray at 10 quarts per acre or 7.5 pounds DNOSBP gave excellent weed control with no apparent deleterious effects on yield or internal appearance of the tubers. Volunteer grains persisted but were pulled by hand; otherwise the soil was not cultivated or hoed. The vines were hilled in the usual manner. At this time 4 of the eight rows previously sprayed with Premerge were sprayed a second time to determine if chickweed could be controlled by this late application. Chickweed failed to germinate on the shoulders of the row sprayed with "Premerge" whereas it grew vigorously on the check rows. The residual effects of "Premerge" persisted for 4 to 5 weeks in contrast to all other treatments where weeds were emerging 10 to 20 days after spraying. C. H. Dearborn, M. F. Babb.

Spacing and fertilizers for 57.44-3.46 Seed pieces of 57.44-3-46 were planted by machine at 9-, 13-, and 15-inch spacing. A 1-4-2 fertilizer ratio was applied with the planter at 4 rates, namely: 15-60-30, 30-120-60, 45-180-90, and 60-240-120 pounds of nitrogen, phosphate and potash per acre respectively. Four Latin square designs were used in the test. Data from the test showed: (1) that the maximum yield of No. 1 tubers was produced by those plots receiving 60 pounds of nitrogen, 240 of phosphate and 120 of potash per acre; (2) that low yields resulted from the lower rates of fertilization (15-60-30 and 30-120-60) irrespective of planting distances; (3) that 9-inch spacing reduces the weight of oversize tubers produced by about 50 percent compared to any other spacing, irrespective of the amount of fertilizer applied, at the same time increasing yields of No. 1 tubers. The results of this particular test indicates that Variety 57.44-3-46 should be planted at 9- to 11-inch spacing, and fertilized (on Knik soil) at the rate of 60 pounds of nitrogen, 240 of phosphate and 120 of potash per acre. Thirteen inches is considered the maximum distance between seed pieces and 45-180-90 pounds of nitrogen, phosphate and potash respectively, the minimum acre fertilizer application for this variety (M. F. Babb, C. H. Dearborn).

Nitrogen and potash versus quality In 1950 two field tests were grown on Knik loamy silt at the Matanuska Station. These tests were factorial designs comparing the influence of nitrogen and potash on both inherently "high" quality potato varieties as grown in Alaska. All plots in both trials received the same phosphate application (537 pounds of 43% treblesuperphosphate per acre, the equivalent of 150 pounds of available phosphate). Nitrogen and potash effects were compared by means of the treatments outlined in the tabulated results (see next 2 pages).

Here it is seen that in Alaska as elsewhere the Burbank varieties are superior in quality to either Chippewa or Earliane #2. Of greatest interest in these comparisions are the following relationships:

1. With respect to yields and specific gravity all four varieties responded in the same manner to nitrogen and potash.
2. Nitrogen did not increase yields, probably because moisture was a severely limiting factor in late season growth.
3. Potash significantly increased the yield of only Russet Burbank, at the same time reducing its specific gravity; a similar tendency was noted in the other 3 varieties.
4. With respect to cooking quality, "good" and "poor" varieties react similarly to nitrogen, differently to potash. The effect of potash is particularly noticeable in baked potatoes, less noticeable in boiled and fried potatoes.

COMPARISON	RUSSET BURBANK						EARLIANE #2					
	Yield			Quality[b]			Yield			Quality[b]		
Fertilizer treatment, pounds/acre	T/A	% #1s	Sp Gr[a]	Bake	Boil	Chip	T/A	% #1s	Sp Gr[a]	Bake	Boil	Chip
Nitrogen 15	5.8	56	965	18	22	18	10.7	93	764	27	23	21
50	5.8	54	1000	19	19	20	11.8	93	746	26	26	22
100	6.5	60	917	21	21	19	11.8	93	738	26	21	23
LSD at 5%	1.2	6.5	59	3	3	1.7	1.2	6.5	59	3	3	1.7
1%	1.6	8.8	79	4	4	2.2	1.6	8.8	79	4	4	2.2
Potash 0	4.6	47	1002	22	19	19	10.7	92	732	25	21	21
20	5.2	52	972	22	20	19	11.5	93	755	27	24	21
60	7.8	67	892	17	24	21	12.0	94	766	26	25	23
120	6.5	59	976	17	21	18	11.6	94	735	27	24	23
LSD at 5%	1.4	7.6	68	4	4	2	1.4	7.6	68	4	4	2
1%	1.9	10.1	91	5	5	3	1.9	10.1	79	5	5	3
Varieties	6.0	57	961	19	21	19	11.4	93	749	26	24	22
LSD at 1%	0.9	5	46	3	3	1	0.9	5	46	3	3	1

ANALYSIS OF VARIANCE[c]

Source	Degrees of freedom (DF) and mean squares								
	DF	T/acre	% #1s	Sp Gr[b]	DF	Bake	Boil	DF	Chip
Total	71				215			911	
Replications	2	57.5**	507**	47	2	0.7	0.46		
Blocks	3	1.1	39	172	3	0.1	0.42		
Blocks x reps	6	(5.2)	61	18	6	(2.0)	(1.74)	1	18.6**
Varieties	1	525.4**	24,193**	8,026**	1	25.4**	3.89**	1	18.6**
Fertilizers	11	6.9**	156*	66	11	1.1*	0.92	11	2.1**
Nitrogen	2'	5.1	56		2'	0.5	0.93	2'	2.0
Potash	3'	15.8**	443**		3'	1.0	1.76*	3'	2.4
N x K	6'	3.0	45		6'	1.3*	0.32	6'	2.1
Var x fert	11	(5.5)	108	112**	11	1.1*	1.94**	11	(1.5)
Error[d]	37	2.2	62	52	155	0.5	0.50	37	0.5

* Significant at the 5% level ** Significant at the 1% level

[a] Specific gravity minus 1 and multiplied by 10,000; mean squares divided by 100.
[b] Cooking quality scored arbitrarily, 10 for good, 20 for fair, 30 for poor.
[c] Interactions in parentheses added to error term in complete analysis of variance.
[d] Error exclusive of interactions shown in parentheses.

* * * * * *

5. Adapted fertilizer practices might be expected to improve inherently poor potatoes to the equivalent of a fair grade of an inherently good variety.

Experience gained in this study shows that consumer acceptance involves both a mealiness factor related to specific gravity, and an independent blackening factor.

Summary (continued from previous page)

COMPARISON	SMOOTH BURBANK						CHIPPEWA					
	Yield			Quality[b]			Yield			Quality[b]		
Fertilizer treatment in pounds/acre	US No 1s	% No 1s	S G[a]	Bake	Boil	Chip	US No 1s	% No 1s	S G	Bake	Boil	Chip
Nitrogen 30	8.1	65	941	21	19	20	10.6	93	807	24	21	22
80	8.1	68	928	16	19	20	10.8	93	752	26	23	21
LSD at 5%	1.4	7	54	4	4	2	1.4	7	54	4	4	2
Potash 0	7.0	63	956	16	16	21	10.8	93	788	28	20	21
60	8.4	66	954	18	23	21	11.0	94	780	21	23	22
120	8.9	71	894	22	17	19	10.4	92	769	25	22	23
LSD at 5%	1.7	8	66	5	5	3	1.7	8	66	5	5	3
1%				7	7					7	7	
Varieties	8.1	67	935	19	19	20	10.7	93	779	25	22	22
LSD at 1%	1.3	7	51	4	4	1	1.3	7	51	4	4	1

ANALYSIS OF VARIANCE[c]
Degrees of freedom (DF) and mean squares

Source	DF	T/acre	% #1s	Sp Gr[b]	DF	Bake	Boil	DF	Chip
Total	35				107			455	
Replications	2	22.1	146	82	2	0.6	0.0		
Blocks	3	0.1	140	81	3	0.1	0.3		
Blocks x reps	6	2.3	(407)	(314)	6	(1.2)	1.3		
Varieties	1	60.8**	6230**	2173**	1	10.1**	2.7*	1	3.7**
Fertilizers	5	3.5**	551	222	5	1.7**	1.9*	5	0.2
Nitrogen	1'	0.1	29	102	1'	0.5	0.1		
Potash	2'	2.4	39	116	2'	1.2	4.7		
N x K	2'	6.5**	443*	3	2'	2.8**	4.6		
Var x fert	5	4.6	(773)	377	5	2.9**	0.5	5	0.6
Error[d]	13	0.9	13	39	61	0.4	0.5	37	0.7

See preceding page for footnotes

During the 1951 season this study was continued to compare the responses of a new unnamed variety(57.44-3-46) with Chippewa and the popular Arctic Seedling as a standard. Statistical analysis of the data (see table on next page) shows a response to nitrogen by all three varieties, with 60 pounds per acre generally producing no more potatoes than 30 pounds. Each increment of nitrogen again decreased specific gravities of the tubers. In this study potash influenced neither yields nor specific gravity; potash likewise had no effect on the proportion of yields graded out as No.1 tubers.

Significant variety differences are seen in the relatively efficient response of Chippewa to heavy nitrogen fertilization; the 60 pound application on this variety produced a larger proportion of No.1 tubers than did the 30 pound level. A nitrogen-potash interaction for all varieties resulted from greater responses

Potato fertilizer trials in 1951

VARIETY & TREATMENT (pounds/acre)	YIELD[a] T/acre[b]	% #1s[c]	Sp Gr[d]
57.44-3-46	14.4	70.7	730
Arctic	12.8	70.7	894
Chippewa	13.8	74.0	687
Nitrogen 0	12.4	72.4	793
30	14.2	72.0	772
60	14.4	71.0	747
Potash 0	13.0	71.6	774
30	14.1	72.0	764
60	13.9	71.9	773
LSD at 5%	1.0	1.7	16
1%	1.3	2.3	21

ANALYSIS OF VARIANCE

Source	DF	Mean squares		
Variety	2	16.4**	99.8**	32,144**
Nitrogen	2	33.0**	14.9	1,413**
Potash	2	9.0	0.8	72
N x V	4	1.1	23.4*	205
N x K	4	8.0	7.5	165
V x K	4	0.4	7.1	30
N x V x K	8	5.2	10.1	57
Error	52	2.8	8.7	86

* Significant at the 5% level
** Significant at the 1% level
[a] Mean of 27 plots
[b] Of U.S. No.1 tubers
[c] Proportion of total yield graded out as No. tubers (in degrees)
[d] Specific gravity minus 1 and times 10,000; mean squares are multiplied by 10,000,000 .

ANALYSIS OF VARIANCE

Source	Matanuska DF	Matanuska Mean[a] squares	Fairbanks DF	Fairbanks Mean[a] squares
Replication	2	186	8	35,172**
Treatment	26	5,301	63	30,339**
Subsamples	1	16	1	4
Interaction[c]	26	102	58	1,704
Error	102	113	680	2,445

**Significant at 1% [a]Original values coded by subtracting 1 and multiplying by 100; mean squares times 10^7.
[c]Treatment x subsamples

to nitrogen at the high potash level. Quality factors appeared to be unrelated to fertilizer treatments, although major differences were found between varieties. Blackening upon cooking again appeared to be an important factor in consumer acceptance; this attribute was not related to specific gravity or mealiness.

In summary, the Burbank varieties seem to be inherently different from such types as Chippewa and Earliane #2. Arctic Seedling and 57.44-3-46 resemble the Chippewa in nutritional requirements and tuber characteristics. These nutritional studies imply that experience gained with Arctic Seedling can be applied just as well to 57.44-3-46. (A. H. Mick, W. M. Laughlin, P. F. Martin)

Minor elements for potatoes An exploratory test on the Kenai peninsula was accomplished with the assistance of a commercial grower who planted and harvested test plots according to directions furnished by the Experiment Station. Compared in this study were calcium, copper, borax, manganese, magnesium, iron, cobalt, and molybdenum. Of these treatments iron applied as ferrous sulfate at 100 pounds per acre decreased yields while calcium applied as ground limestone at 500 pounds per acre increased yields by a highly significant amount. All others had no effect on yields at this particular site. (W. M. Laughlin)

Experimental error in measuring bulk specific gravities In processing the 1951 nutritional plot yields, sufficient quantities were avaiable to provide two subsamples for many plots. Specific gravity values were obtained for each of these subsamples, all details of the regular processing technique being followed. These data were then subjected to analysis of variance to give the results outlined in the table at the left.

The technique of sampling total plot yields and of measuring the specific gravity of this sample is thus seen to be free of large errors. Half of each plot yield, which amounts to 20 to 45 pounds for a 20-hill plot, is adequate for a very precise determination of specific gravity.

(W. M. Laughlin)

Fertilizers for Arctic Seedling potatoes At the Fairbanks Experiment Station a 4^3 factorial experiment in randomized incomplete blocks was laid out as an 8 x 8 balanced lattice with 9 replications on Chatanika silt loam. Statistical analysis of the data (see table at left) collected from this test indicated a yield response to all three fertilizer constituents. Sixty and 120 pounds of nitrogen per acre produced no larger yields than 30 pounds. With respect to phosphate, 120 and 240 pounds per acre were no better than 60. Each increment of potash increased yields by a highly significant amount. Highly significant interactions existed between both nitrogen-and-potash and phosphate-and-potash. The highest yields were obtained with a 1-4-2 ratio of nitrogen, phosphate and potash. That tuber size is influenced by fertilizers is revealed in the fact that increasing amounts of nitrogen and phosphate decreased the proportion of U.S. No. 1 potatoes while the proportion increased with increases in potash. Here again a nitrogen-potash interaction proved significant.

TREATMENT Pounds/A		YIELD[a] T/acre[b]	% #1s[c]	Sp Gr[d]
Nitrogen	0	9.2	71.4	874
	30	10.5	71.6	872
	60	10.5	70.8	844
	120	10.0	70.2	794
Phosphate	0	9.8	72.4	811
	60	10.3	71.5	850
	140	10.3	70.3	856
	240	10.0	69.9	863
Potash	0	8.3	67.8	873
	30	10.0	71.0	855
	60	10.9	72.7	846
	120	11.1	72.5	807
LSD at	5%	0.4	0.9	11
	1%	0.5	1.2	15

ANALYSIS OF VARIANCE

Source	DF	Mean squares		
Replication	8	33.2**	67**	274**
Treatment	63	19.4**	71**	215**
Nitrogen	3	52.8**	62**	2,198**
Phosphate	3	8.3*	190**	781**
Potash	3	227.6**	740**	1,116**
NP	9	2.8	20	43
NK	9	20.3**	76**	17
PK	9	8.8**	26	30
NPK	27	2.5	14	17
Blocks	63	7.8	22	47
Error	441	2.3	14	21

*Significant at the 5% level
**Significant at the 1% level
[a]Means of 144 plots
[b]Of U. S. No. 1 tubers
[c]Proportion of total yield graded out as U.S. No. 1 tubers (in degrees)
[d]Specific gravity minus 1 times 10000; mean squares are divided by 100

Specific gravities were found to decrease with increasing applications of nitrogen and potash while they increased with increasing applications of phosphate.

Although 1951 was a favorable season for potato production, increases obtained from fertilizers were of small magnitude compared to increases usually obtained from similar treatments on forage crops. Heavy fertilization of forage generally yields 4- or 5-fold increases, with 7- and 8-fold increases not uncommon. In contrast, the best treatment in the 1951 potato fertilizer trials (30 pounds of nitrogen, 120 of phosphate and 60 of potash, per acre) produced only a 30 percent increase. In cash returns, however, this treatment, which cost about $45, returned an extra 3 tons of high quality No. 1 tubers over "no treatment". At current market prices this 3-ton increase is worth $240, making a cash return of $200 for $40 spent on fertilizer (A.H. Mick, W. M. Laughlin, P. F. Martin).

PUBLICATIONS: Interagency and interdepartmental reports, news releases and Circular 13.

PROJECT NUMBER AND FUND: AL-1-2-8(T)

PROJECT TITLE: Vegetable Culture, Storage and Processing Investigations

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: M. F. Babb, C. H. Dearborn, A. Kallio, W. M. Laughlin

LOCATIONS: Matanuska and Fairbanks Experiment Station

COOPERATION: Filtrol Corporation, 3250 East Washington Blvd., Vernon, Calif.

OBJECTIVE OF WORK: To determine if pelleting of vegetable seeds can be used as a method of delaying germination so that chemical sprays can be used to kill the early emerging weeds; to determine which method of growing cabbage is more practical (1) to seed in flats in the greenhouse and transplant to the field or (2) sow the seeds directly in the field; and to determine the nutritional requirements of red beets and onions at several sites in the Matanuska Valley.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Nutritional studies will be enlarged in scope and distribution. Transplanting versus direct seeding of cabbage will receive continued attention. Chemical weed control studies on the crucifers, lettuce, beets and radishes will be initiated.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Truck and market gardening are important agricultural enterprises in Alaska. Although only minor benefits have so far been realized from this project because of limited support, a great deal of assistance is needed in this field. It has already been demonstrated that transplanting produces earlier marketable cabbage, a practice which will serve to prolong the market season.

PROGRESS DURING THE YEAR: The three lines of attack are reported separately as follows:

Pelleted versus normal seeding. Pelleted seeds of cabbage, carrots, lettuce, and radish were planted adjacent to normal seeds from the same seed lots. All seeds were planted by hand. Delayed emergence of the vegetables as a result of pelleting was not clear cut. The effect of pelleting on germination was very significant. Only 10 percent of the pelleted cabbage seeds germinated, whereas 50 percent of the normal seeds made satisfactory plants. Carrots and radishes showed a slight trend toward better germination from the normal seeds. With lettuce the trend was toward higher germination from the pelleted seeds.

Transplanting versus direct seeding of cabbage. Three varieties of cabbage, Golden Acre, Midseason Market and Oakview Ballhead representing early, midseason and late cabbage respectively, were grown in a well randomized design of 4 replicates. Seeds for the transplants were sown in flats in the greenhouse April 10 and seedlings set in the field May 15. Seeds of the same varieties were sown directly in the field on May 11.

Eighty percent of the transplants of Golden Acre made marketable heads and were harvested 76 days after field setting, whereas only 16 percent of the plants grown from direct seeding in the field developed marketable heads. This 16 percent that was harvested matured 3 weeks later than the transplanted cabbage and would have missed the early market.

Approximately 50 percent of the transplanted plants of Midseason Market and Oakview Ballhead developed marketable heads, the remainder being soft-headed or immature. Direct seeding in the field of these two varieties resulted in 18 percent marketable heads from Midseason Market and less than 5 percent from Oakview Ballhead. These results indicate that more cabbage can be obtained per acre from transplanting cabbage plants to the field than from direct seeding.

Fertilizers for red beets and onions. A factorial field study compared the responses of red beets and onions to two levels each of nitrogen, phosphate, and potash at five locations in the Matanuska Valley. Except at one location, responses to treatments were confounded with deficient soil moisture at planting time, severe cutworm infestations and erosive wind damage. Although vegetative responses to additions of phosphate were apparent in the field at most locations, measurable differences attributed to treatments were obtained only with red beets at two sites. At these locations 100 pounds of nitrogen per acre was much superior to 50 pounds. Greatest responses to nitrogen were obtained in the presence of high levels of both phosphate and potash (300 and 50 pounds per acre, respectively). While phosphate was particularly conspicuous in encouraging early growth, by harvest time these differences had disappeared (W. M. Laughlin).

PUBLICATIONS: Interdepartmental reports and contribution to Circular 13, revised.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-2-9(F)

PROJECT TITLE: Vegetable Forcing Investigations

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: M. F. Babb, Arvo Kallio, and C. I. Branton

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: Agricultural Engineering Department

OBJECTIVE OF WORK: To determine the most suitable varieties and methods for the winter forcing of such crops as rhubarb, asparagus, witloof, etc., and to investigate the possibilities of building suitable forcing structures wholly from native materials or of using existing greenhouse structures for the purpose.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: A drastic cut in the Experiment Station appropriation for this year made it impossible to construct a forcing cellar. Should the cut in appropriations be restored, and especially if an increase is obtained, it should be possible to construct a suitable forcing cellar during the coming summer and conduct preliminary forcing investigations next winter.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Except for the collection and propagation of forcing stocks of rhubarb, it has been impossible to initiate work on this project. See items 8 and 10 of this line project report.

PROGRESS DURING THE YEAR: At the Matanuska Experiment Station all forcing stocks of rhubarb 2 years old or older were lifted and divided for increase and 4 varieties (Sunrise, Kusnachter, Red Delicatesse and Cyklop) were added to those under test. At the Fairbanks Experiment Station the varieties Linnaeus, Victoria and Sunrise were added to the collection of rhubarb varieties under test and all stocks on hand were lifted and divided to increase the number of plants. An asparagus nursery will be started from seed next spring.

PUBLICATIONS: None.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-2-10(F)

PROJECT TITLE: Variety Testing and Culture of Ornamentals

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: M. F. Babb and Arvo Kallio

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: United States Forest Service

OBJECTIVE OF WORK: To determine the hardiest and most suitable types of ornamental plants for Alaskan conditions and to develop methods for their culture

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Except for the maintenance and propagation of stocks already on hand, it is proposed to hold work on this line project to a minimum during the present emergency.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Though our own store of knowledge and experience is as yet very limited, we have rendered assistance in the landscaping of the Kodiak Island Naval Base, the Mt. Edgecombe Hospital in Southeastern Alaska, the Ft. Richardson Air Base at Anchorage as well as in many other lesser projects both public and private.

PROGRESS DURING THE YEAR: At the Matanuska Station an inventory of the ornamentals purchased as nursery stock and planted in the spring of 1950 shows that of 81 species originally set 52 are still represented by living specimens (see next page for list of surviving species). Many still living show signs of severe winter injury and it is to be expected that they will eventually die.

Of the 70 species of trees and shrubs planted as seed in 1950, 58 species germinated in 1951 and 17 made sufficient growth to warrant transplanting them into the open ground. Other plantings of ornamentals at the Matanuska Station during the past year included the following: Day Lilies (7), Miscellaneous Lilies (8), Iris (7), Peonies (7), Phlox (10) and Gladioli (25).

At the Fairbanks Station plantings of annual flowers consisted of 69 varieties representing 17 species, as follows: Argeratum (1), Antirrhinum (9), Asters (3), Calendula (1), Annual chrysanthemums (2), Cosmos (7), Lobelia (3), Marigolds (7), Nasturiums (6), Nemesia (1), Pansies (9), Petunias (8), Phlox (2), Schizanthus (1), Sunflowers (2), Stocks (3), and Zinnias (4). Observations were made and recorded as to their relative merits for culture in Alaska.

Additions to the test plantings of trees, shrubs and herbaceous perennials included the following planted as nursery stock: Amelanchier (1), Chives (1), Cranberries (1), Evergreens (7), Miscellaneous Lilies (8), Iris (7), Day Lilies (7), Peonies (7), Phlox (10) and Roses (15).

A fall planting at the Fairbanks Station included 8 species of trees, 16 species of shrubs and 23 species of herbaceous perennials.

PUBLICATIONS: None.

LIST OF SURVIVING TREES AND SHRUBS PLANTED AS NURSERY STOCK IN 1950

Acer ginnala
Acer negundo
Acer saccharinum
Amelanchier sp.
Betula pendula
Fraxinus lanceolata
Juniperus communis var. hibernica
Juniperus chinensis var. Pfitzeriana
Malus baccata) 4
Malus sp.)
Pinus mugo
Populus sp.
Prunus sp. (2)
Shepherdia argentea
Sorbus americana
Ulmus americana
Ulmus americana x siberica
Ulmus pumila
Caragana arborescens
Caragana pygmaea
Cornus aurea
Cornus baileyi
Cotoneaster acutifolia
Cotoneaster integerrima
Lonicera tartarica
Lonicera sp.
Pinus mugo
P. E. I. 160 145
P. E. I. 168 937
Rhamnus cathartica
Rhus aromatica
Spirea froebelli
Spirea van houttei
Syringa sp. (16)
Virbunum lantana

LIST OF TREES AND SHRUBS RAISED FROM SEED PLANTED IN 1950

*Acer ginnala
Acer glabrum
*Acer negundo
Ailanthus altissima
*Atraphaxis buxifolia
Caragana arborescens
Caragana microphylla
Celtis occidentalis
*Colutea arborescens
Cornus stolonifera coloradensis
Crataegus rivularis
*Eleagnus angustifolia
*Eleagnus commutata
*Fraxinus lanceolata
Halimodendron halodendron
Larix decidua
Ligustrum vulgara
Lonicera alpina
Lonicera bella alpida
Lonicera bella candida
Lonicera bella rosea
Lonicera gibbiflora
Lonicera gibbosa
Lonicera sp.
*Lonicera tartarica lutea
Lonicera sibirica
Lonicera xylosteoides
Phellodendron amurense
Physocarpus intermedius
Physocarpus monogynus
Picea abies
Pinus aristata
*Prunus americana
*Prunus amygdalus
*Prunus besseyi
*Prunus melanocarpa
*Prunus nana
*Prunus tomentosa
*Prunus virginiana
*Prunus sp.
Ptelea angustifolia
Ptelea orophylla
Rhamnus cathartica
Rhamnus chlorophora
Rhamnus erythrocarpa
Rhamnus oleoides
Rhamnus saxatilis
Rhus aromatica
Rhus copallina
Rhus glabra
Ribes aureum
Robina neo-mexicana
Rosa maximowicziana
Rosa rubrifolia
Shepherdia argentea
*Sorbus aria
Tillia americana
Ulmus americana

*Stocks of the species marked with an asterisk were removed from the nursery beds and transplanted in the open ground.

PROJECT NUMBER AND FUND: AL-1-2-11(F)

PROJECT TITLE: Tree Fruit Variety Testing and Culture

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: M. F. Babb, Arvo Kallio

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: None.

OBJECTIVE OF WORK: Variety tests coupled with cultural investigations to determine the potential hardiness of tree fruit varieties and the possibility of fruit production in Alaska.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Conforming to the usual procedure for such tests, the search will be continued for varieties of all tree fruits considered to have possibilities of being adapted to culture in Alaska. Seeds have been obtained of several species of apples and cherries and are now being stratified and will be sown in the nursery beds in the spring. If possible nursery stock of some of the more hardy tree fruit varieties will be purchased for growing under experimental conditions calculated to enhance their natural hardiness.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: In this particular type of work it is unsafe to make predictions and only after a period of years can one be reasonably sure of results. However, from present indications it appears possible that certain tree fruits, such as crab apples, certain species of cherries, some of the cherry-plum hybrids and perhaps Prunus tomentosa may yet prove hardy in the Matanuska Valley under suitable methods of culture.

PROGRESS DURING THE YEAR: The variety test planting at the Matanuska Station increased by 5 varieties of crab apples (Adam, Osman, Red Siberian, Rescue and Sylvia), 3 standard apple varieties (Renown, Reward and Heyer No. 12), 2 plums (Dropmore Blue and Mandarin) and 1 cherry (Mongolian). The entire planting was pruned, fertilized and cultivated. An inventory of the planting last fall disclosed that of the original 131 varieties planted, 96 or 73.28 percent, were still represented by living trees and that of the trees set 50.65 percent were still living. Of course many of the trees still living are in a very weakened condition and are not expected to survive. However, the following varieties or species all made good growth and appear thrifty or have one or more trees answering this description: Standard apples; Red Duchess, Erickson, Dwarf Yellow Transparent and Victory. Crab apples; Transcendent, Golden Anniversary, Trail and Dolgo. Cherries; Compass, Dakota Amber, Korean No. 57, Hansen's Super Bush and the Western Chokecherry. Plum; Minnesota No. 101. Apricot; Scout.

Tree fruit plantings at the Fairbanks Station during the past year included 4 varieties of standard apples (Reward, Bayer # 3, Heyer # 12 and Renown); 5 varieties of crab apples (Adam, Osman, Red Siberian, Rescue and Sylvia) and 1 cherry variety (Mongolian).

PUBLICATIONS: None.

PROJECT NUMBER AND FUND: AL-1-2-12(F)

PROJECT TITLE: Small Fruit Variety Testing, Breeding and Culture

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: C. H. Dearborn, Arvo Kallio, M. F. Babb

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: Oregon, Geneva, N. Y., and Beltsville Md. Experiment Stations

OBJECTIVES OF WORK: Variety tests to determine the hardiness and suitability of such small fruits as strawberries, raspberries, blueberries, currants, gooseberries, Nanking cherries (Prunus tomentosa), sand cherries, sand cherry x Prunus tomentosa hybrids, etc. for culture in Alaska or for use as parental lines in crosses designed to create hardy varieties. Investigations of cultural methods and fertilization of small fruits as influencing their hardiness and the possibilities of their culture in Alaska.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: A virus-free stock of Marshall strawberry will be introduced from Oregon and increased at the Matanuska Station. Pollen of several desirable commercial varieties of strawberries will be obtained from Stateside workers for crossing with plants of our native and Sitka strawberries in an attempt to develop a productive winter-hardy variety.

Strawberry seed gathered in 1949 from plantings abandoned by earlier settlers was planted to provide material for selections. These plantings are presumed to have been the so called " Sitka Hybrids" which were released over a decade ago as a result of Dr. C. C. Georgeson's hybridization work.

Several local lines of raspberries will be crossed with the commercial varieties, Washington, St. Regis and Ruddy. A new raspberry bed will be set for yield tests and cultural studies. The search for hardy varieties of bush fruits will continue at both stations.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTION SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: By the testing of a relatively large number (28) commercial varieties of strawberries in comparison with 33 selections which for the most part appear to be Sitka Hybrids, it was shown that present-day commercial varieties unmulched were not hardy at the Matanuska Station whereas some of the so-called Sitka Hybrids survived under the same conditions and developed normal runner plants. Consequently it is possible to advise prospective strawberry growers that the Sitka Hybrids are the better investment at the present time.

PROGRESS DURING THE YEAR: The fall and winter of 1950-1951 was extremely hard on all types of small fruits in the Matanuska Valley and many growers lost their entire plantings. In the strawberry test at the Matanuska Station not a single plant of the 28 commercial varieties survived. However, 10 of the native or Sitka Hybrid varieties survived and these were transferred to a more favorable location for propagation.

All raspberries suffered severe winter injury and 7 varieties were completely killed. However, of the 17 surviving varieties Sunbeam, Chief, Latham, St. Regis, Washington, Ruddy and Durham Everbearing showed evidence of possessing considerable winter hardiness.

Practically all currant varieties showed winter injury, but of the commercial varieties only Cascade, Red Cross and the Grape currant were totally killed.

Of the 8 gooseberry varieties Carrie, Houghton, and Josselyn were totally killed and those surviving showed severe winter injury.

Test plantings of small fruits at the Fairbanks Station during the past year included 10 varieties of currants, 4 varieties of gooseberries and 12 varieties of raspberries. A strawberry nursery was started from plants collected from old strawberry beds in and around Fairbanks and selected plants from an old strawberry bed at the Experiment Station. A seedling nursery was also planted from seed collected the previous year. Great variation as to plant type, leaf characteristics and runner habit were noted in this seedling stock. The nursery will be expanded next year by further collections of hardy plants and seed throughout the Tanana Valley and parental material selected to initiate a strawberry breeding program.

Hardwood and softwood cuttings were made from selected plants of the collection of native blueberries (Vaccinium uliginosum) at the Fairbanks Station as a means of increasing stocks of the more desirable types.

PUBLICATIONS: None

PROJECT NUMBER AND FUND: AL-1-2-13(F)

PROJECT TITLE: Vegetable and Flower Production in Greenhouses

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: M. F. Babb, C. H. Dearborn and Arvo Kallio

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: None

OBJECTIVE OF WORK: To determine the most suitable crops and varieties for greenhouse culture in Alaska and the influence of such factors as fertilization, watering practices, time and methods of planting, light duration and intensity on production. Secondarily, it is considered important to investigate the possibility of winter crop production in greenhouses and the possibilities of using such structures for the winter forcing of such crops as rhubarb, asparagus, etc., to supplement the rather scanty supply of fresh winter vegetables.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: As reported last year, the small greenhouse at the Matanuska Station is now taxed to its limits for propagation purposes and therefore unavailable for this type of work. Construction work on the new greenhouse range at the Palmer Station pas progressed to the point where the main houses are practically completed. However the head house has not been built; flats, pots, soil bins and all such equipment still has to be purchased or constructed and the ground beds and benches filled with soil. Present appropriations do not permit the building of a head house or the purchase of the necessary equipment and it will be impossible to fill the beds and benches with soil in time to use them next summer. For these reasons it will not be possible to initiate work on this line project during the coming year.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: The only work that has been possible was a small scale or pilot test conducted in the old greenhouse at the Matanuska Station in 1949. But even this small-scale test demonstrated the superiority of certain tomato and cucumber varieties over those commonly grown in the Valley and resulted in their adoption by several growers.

PROGRESS DURING THE YEAR: Work on this project at the Matanuska Experiment Station was held in abeyance during the past year.

Greenhouse facilities at the Fairbanks Experiment Station are limited to one small, poorly constructed greenhouse, approximately 14 x 20 feet in size. Heat is supplied by an oil-burning heater located in the house. Under such conditions an even distribution of heat is impossible and the small size of the house practically limits its usefulness to propagation purposes. However during the past season a small scale tomato variety test was conducted with 5 varieties (Burpee Hybrid, Spartan Hybrid, Northern Hybrid, Burpee Big Boy and Michigan State Forcing). Burpee Hybrid produced a good crop of ripe tomatoes. The other varieties were severely checked by damping off and produced only a few green fruits. Further testing is necessary to determine the relative merit of these varieties.

PUBLICATIONS: None.

PROJECT NUMBER AND FUND: AL-1-2-14(F)

PROJECT TITLE: Vegetable Variety Testing and Breeding

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: M. F. Babb, C. H. Dearborn and Arvo Kallio

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: Division of Fruit and Vegetable Crops and Diseases

OBJECTIVE OF WORK: Variety testing in an attempt to find vegetable varieties and even crops best adapted to culture in Alaska or that have characteristics making them valuable as parental material in a breeding program designed to produce adapted varieties.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Systematic variety tests will be continued at the Matanuska and Fairbanks Stations with lettuce, cabbage, beans, turnips, carrots and possibly with other crops.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Lettuce variety trials have strongly indicated that a U. S. D. A. numbered selection, 3310, is superior to any of the present day commercial varieties in yield, size, type of head and freedom from premature seed stalk formation. Lettuce growers in the Matanuska Valley have asked for its introduction as a named variety and the matter is now under consideration. In view of the importance of lettuce production in Alaska this finding, if verified by further tests, should prove of great value to both the growers and the consuming public in the Territory. Cabbage variety trials have indicated that there are varieties that will consistently outyield the varieties now commonly grown in the Matanuska Valley by 33 percent.

Incidental to the broccoli tests, a satisfactory method was devised for the application of maggot control chemicals by the use of a hooded spray shoe which applies the materials at the base of the plants without wetting the foliage. This device was so successful in eliminating hand labor that it is now being adopted by growers.

PROGRESS DURING THE YEAR: The systematic testing of lettuce varieties (initiated last year) was continued at the Matanuska Station by a test which included 12 commercial varieties and 3 numbered, unnamed selections supplied by the Division of Fruit and Vegetable Crops and Diseases. The relative merit of these varieties and selections, as judged by total weight of marketable heads produced was: Cornell #456, #3310, #4164, Premier Great Lakes, Great Lakes #659, Imperial #44, #4183, Great Lakes #428, Pennlake, Great Lakes #407, Progress, Imperial #152, New York Supreme #55, New York #515, and Improved #615 (101). In general, long-standing ability or freedom from early bolting characteristics coincided with yielding ability. These results, which are closely similar to those obtained last year, indicate that the numbered selection 3310 is well adapted to the Matanuska Valley and consideration is being given to its introduction.

A systematic test of 20 varieties of cabbage was conducted at the Matanuska Station during the past year. The relative merit of these varities as determined by relative yielding ability was: Bugner C-1, Wisconsin Ballhead, Jaatun, Ferry's Hollander, Seidl Ballhead, Bonanza, Globe, All Head Select, Marion Market, Glory of Eukhuizen, Resistant Detroit, Early Cortland, Early Jersey Wakefield, Gloden Acre, Gruner Edelstein, Wunderkopff, O-S Cross, Hybrid Cabbage, Langendijker and Winterfrust. The last 6 varieties in the list proves to be too late maturing for this region, but among the 14 that did produce marketable heads some appeared to be superior to the varieties now commonly being grown in the Matanuska Valley.

Broccoli breeding was initiated at the Matanuska Station during the past year with a planting of 5 varieties representing various types of present day commercial varieties. Crosses were made among these varieties with the objective of creating an earlier maturing, better adapted type for culture in Alaska. A severe maggot infestation in this planting let to the testing of the hooded spray shoe for the application of maggot control chemicals. This shoe is designed to apply the chemicals to the roots of the plants without wetting the foliage. This proved to be a very rapid and effective method of maggot control in that it eliminates the need for the slow, costly hand method of application now in use by growers in Alaska.

In conjunction with the brocoli breeding a systematic test was made of 7 varieties, as follows: Waltham #7, #11, #29, Texas #107, Earligreen, Morse's Early and Morse's Late. Although this planting was too late maturing to produce maximum yields, it indicated that Waltham #29, Texas #107 and Morse's Early were the most desirable in the order listed.

Tests were initiated at the Fairbanks Experiment Station during the past summer to determine the characteristics and merits of a wide range of vegetable varieties and strains as influenced by soil and climatic conditions in the Tanana Valley.

These tests included 287 varieties and strains of vegetables representing 41 species of plants, as follows: beans 21, beets 18, carrots 36, chinese cabbage 2, sweet corn 8, cucumbers 2, herbs 9, kohlrabi 2, lettuce 9, parsnips 12, parsley 2, peas 25, radish 18, rutabage 9, spinach 5, tomatoes 14, miscellaneous vegetables not included in the preceding list 17. Also under test were 302 varieties and strains of beans representing a part of the world-wide "Shoemaker-Tracy" collection and native beans secured from various Indian tribes living in the high altitude sections of the southwest United States. As was to be expected, the majority of these beans did not mature, but 79 varieties were saved for further testing. Complete notes and yield data were taken on all types and varieties of vegetables tested, but in the interest of brevity are not included in this report.

PUBLICATIONS: The results of these tests have been made available to the public by the issuance of the mimeographed list of recommended vegetable varieties thru the Territorial Extension Service.

PROJECT NUMBER AND FUND: AL-1-3-1(H)

PROJECT TITLE: Raising Dairy Calves

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: William J. Sweetman, Wallace Middleton and Fred Swingle

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: Bureau of Dairy Industry

OBJECTIVE OF WORK: To develop efficient rations and methods of raising dairy calves in Alaska and to compare several rations for growing calves as measured by weight gains, health and efficiency of feed utilization.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Powdered skim milk is becoming harder to obtain so some attention will have to be given to rations containing other milk substitutes. The importance of aureomycin in diets up to 150 days of age will also be studied.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Several rations and methods have been developed that will raise calves in Alaska on a minimum of whole milk. Powdered skim milk will raise calves cheaper and with only the colostrum milk thus enabling homesteaders without cows to raise a few calves.

PROGRESS DURING THE YEAR: Seven Guernsey calves were raised on skim milk powder to 60 days and Alaskan grains except for soybean meal. Seven more were raised on skim milk powder to 60 days and commercial dairy ration. There were no differences in rate of growth. The first gained at the rate of 1.18 pounds per day and the latter at 1.15 pounds per day up to 6 months of age. Calves will grow just as well on Alaska grown grains as on grains shipped in from the States.

Seven Holstein calves were raised on whole milk to 45 days and Alaska grains. Seven more were raised on skim milk powder to 60 days and a commercial dairy ration. The first group had a daily gain of 1.33 pounds and the second 1.39 pounds per day. The group on skim milk powder gained just as fast as those on whole milk for a longer period. It costs about $20.00 less to raise them to 6 months of age on powdered skim milk than when whole milk is fed.

PUBLICATION: Raising Dairy Calves and Heifers in Alaska.

PROJECT NUMBER AND FUND: AL-1-3-2(F)

PROJECT TITLE: The Effect of Extra Light on Milk Production and Reproduction

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: William J. Sweetman, Wallace Middleton and Fred Swingle

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: Bureau of Dairy Industry

OBJECTIVE OF WORK: To determine if lengthening the period of light to which Alaska cows are exposed during the winter favorably affects milk production and reproduction.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: All heifers available over 1 year of age will continue to be put on this experiment to increase the number of heifers that are exposed to the short day and extra light.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: The trend seems to be for more heat periods and better conception with extra light but very little difference in milk production.

PROGRESS DURING THE YEAR: The results of the effect of extra light on milk production were very much the same for 1951 as 1950. Cows going into the winter with the gradual shortening of days seem to do as well as cows having extra light. However if they are changed from light to dark abruptly they fall off in production much faster than those changed to extra light.

In 1950-51 we had 5 cows in each group. One group started in extra light and the other without extra light. They were changed in the middle of the winter. At the beginning of the winter the "light" group averaged 32.3 pounds per day of fat corrected milk; the "dark" group averaged 39 pounds per day. The last 10 days before the change they averaged 26 pounds and 31.5 pounds per day respectively. The last 10 days after the change their production was 19 pounds and 28.4 pounds respectively.

The total production of the 10 cows while on extra light was 17,463 pounds and while in the dark 17,129 pounds.

Heifers definitely have more heat periods when supplied extra light. Six heifers over a year of age were divided into 2 groups, one supplied with extra light the other without. The groups were changed on December 21, the shortest day. Both groups were watched very carefully. The 6 heifers did not miss a single heat period when supplied with extra light although they missed 4 heat periods while not supplied with extra light.

PUBLICATIONS: None.

PROJECT NUMBER AND FUND: AL-1-3-3(R)

PROJECT TITLE: Dairy Cattle Breeding Investigations

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: William J. Sweetman, Wallace Middleton and Fred Swingle

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: Bureau of Dairy Industry

OBJECTIVE OF WORK: In order to improve the producing ability of Alaska dairy cattle a breeding research program is needed to develop superior germ plasm and this germ plasm should be made available to the farmers of Alaska through artificial insemination.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Emphasis will be placed on proving the bulls that have been in use in this program. Their daughters started to calve in March of 1951 so a considerable number will complete their first lactation in 1952.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Three hundred sixty cows were bred artificially the first year (May 1948 to April 1949), 509 cows were bred the second year, and 560 the third year. From May to December of 1951, 421 cows have been bred. A few heifers have now been milking 10 months. Around 50 have now calved and are milking very well. The most of them show promise of being better than their dams.

PROGRESS DURING THE YEAR: The rate of conception has been gradually going up. There were 1,053 services in the year 1950-51, May to April, with 580 non-returns or 55 percent. Most of the non-returns are in calf because if a cow does not get with calf we are told about it. In the first 5 months of 1951 (May to August) the percentage of non-returns was 66 percent which is much higher than the same months of any year so far. Since the start of the program 1,850 cows have been bred.

The Holstein bull formerly used at Fairbanks now has 13 daughters that have completed first lactations. They have a mature equivalent average of 13,794 pounds milk and 474 pounds of fat. Their dams have a mature equivalent average of 13,678 pounds milk and 457 pounds fat. This bull now has been transferred to the Matanuska Station and will be used in the artificial breeding program. All the cows that could be bred during May to October in the Fairbanks herd were bred artificially to the bulls at Matanuska. Four calves were born in the Fairbanks herd this year that were bred to the Matanuska bulls artificially.

The first crossbred heifer in the Matanuska Station herd calved on May 2, 1951 at the age of 2 years and 2 months; in 8 months she has produced 5,893 pounds of milk and 256 pounds fat. Her purebred sister calved April 26, 1951 at the age of 3 years and 1 month (second calf); in 8 months she has produced 4,437 pounds of milk and 217 pounds fat.

We now have 6 Red Dane-Guernsey crossbred heifers, 5 Holstein-Guernsey crossbred heifers, one Guernsey-Holstein crossbred heifer, one Red Dane-Holstein crossbred heifer and one Holstein-Red Dane-Guernsey crossbred heifer.

PUBLICATIONS: None.

PROJECT NUMBER AND FUND: AL-1-3-6 (T)

PROJECT TITLE: Feeding of Fur Animals

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: James R. Leekley

LOCATION: Experimental Fur Station, Petersburg, Alaska

COOPERATION: N. R. Ellis and Charles E. Kellogg of the Bureau of Animal Industry, Washington, D. C., and Dr. James McGinnis, Professor in Poultry Husbandry at Washington State College, Pullman, Washington, assisted in designing the two mink experiments reported herein.

OBJECTIVE OF WORK: To carry on feeding experiments with mink, marten, foxes and their various mutations; to determine the value of raw, fresh, and processed fish, fish waste, by-products of fish canneries and cold storages, and such sea mammals and their by-products as are available in Alaska.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Mink Experiment No. 22, starting early in February and terminating about the first week of July, will continue our study of salmon cannary waste products and the use of antibiotics in the ration of ranch mink during the breeding, gestation, and suckling periods. Rations containing high percentages of raw chum salmon waste, pink salmon waste without heads, and salmon viscera (salmon waste without heads, tails or fins) will be compared with a ration containing raw pink salmon waste. The ration of half the mink on each experimental ration will be supplemented with pure aureomycin, to obtain information on its use in promoting the health and growth of young mink, and its effect on the "yellow fat" disease of mink, usually experienced when rations high in salmon products are fed to young mink during the month of June. Feeding experiments starting July 15 will be designed to investigate the use of the above or similar fish waste products in the diet of young mink during their growing and furring out season, and further study the use of antibiotics during this period. If animals are available, similar feeding trials will be carried on with adult and young foxes.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Results of one experiment indicate that crude aureomycin supplement (APF-5) is beneficial to the production and growth of young ranch mink receiving rations containing high percentages of salmon waste.

Processed or canned salmon waste is inferior to raw salmon waste or raw salmon waste without heads from the standpoint of production, health and rate of growth of young.

Alpha-tocopheryl acetate at a level of 40 gms. per pound of ration fed prevents "yellow fat" disease normally experienced among young mink receiving rations high in salmon products.

Pure aureomycin, added to mink rations containing high percentages of salmon waste, promotes better health, rapid growth and is beneficial in preventing the "yellow fat" disease of mink.

PROGRESS DURING THE YEAR: Two mink feeding experiments were continued this season.

Mink Experiment No. 20 compared four basic rations, half of the female mink on each ration receiving crude aureomycin supplement during their breeding, gestation and suckling period. Characteristic features of these four rations were: 80 percent pink salmon waste, 70 percent flounders, 84 percent pink salmon waste without heads, and 84 percent canned salmon waste. Of these basic rations 80 percent pink salmon waste proved the best producing an average of 4.4 kits per female whelped. The other three rations proved equally inferior, averaging 3.6, 3.5 and 3.8 kits respectively. Salmon waste without heads produced kits that remained most healthy; canned salmon waste proved most unhealthy, 23 kits being lost.

Aureomycin was of definite benefit in all rations; kits whose mothers received this supplement had higher average weaning weights for all four rations. Flounder was an expensive feed because more was consumed and the initial cost was high; canned salmon waste was also expensive because of processing costs.

Mink Experiment No. 21 was designed to study the role of Vitamine E in "yellow fat" disease, and also the use of aureomycin in the ration of young growing mink. It carried 8 lots of 36 kit mink through their growing and furring out period. Control rations, containing high percentages of flounders and salmon waste, were compared with similar rations supplemented with 40 mgs of alpha-tocopheryl per pound of feed, 40 mgs of aureomycin per 100 pounds of feed, and combinations of these two products.

No losses were experienced from "yellow fat" on rations containing tocopheryl, whereas 18 out of 19 animals pelted on the salmon waste control lot were afflicted with this malady. Aureomycin also prevented "yellow fat". Seven out of 27 animals pelted from the salmon waste ration containing this supplement showed a trace of this malady, though no losses occurred. Aureomycin was of definite benefit from a health standpoint; only 3 animals were lost from the 4 lots receiving this supplement, as against 32 losses in the other 4 lots. This is further borne out by the more rapid rate of development and the increased size of the animals which received this antibiotic. All the rations fed were deficient, as evidenced by the high number of cotton pelts produced; aureomycin and alphatocopheryl were not beneficial in controlling this condition.

PUBLICATIONS: A progress report "The Utilization of Salmon Cannery Waste for Fur Animal (Mink) Feed", written in cooperation with the Fishery Products Laboratory at Ketchikan, has been submitted to Washington for publication.

PROJECT NUMBER AND FUND: AL-1-3-7

PROJECT TITLE: Breeding of Fur Animals

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: James R. Leekley

LOCATION: Experimental Fur Station, Petersburg, Alaska

COOPERATION: None

OBJECTIVE: To cross blue foxes, arctic white foxes, and mutation blue foxes, in order to determine their dominance and color variations, and possibly produce a new mutation blue fox. To increase the quality of the station mink herd by the introduction of high quality mink purchased in the States and wild mink trapped in various localities in Alaska. To obtain consistant reproduction of marten.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: The breeding program carried on last year involving crosses of blue, white and mutation blue foxes to determine the dominance of these different color phases and the color variations produced by such matings will be continued in 1952. The wild tundra mink, obtained a year ago last September, will be crossed with the pastel mutation mink in an effort to produce a large lighter colored pastel. We will also endeavor to build up our small nucleus of tundra mink for future experimental work. Continued efforts will be made to obtain consistant production from marten in captivity.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH WOULD JUSTIFY CONTINUED SUPPORT OF THIS WORK: In fox, white is recessive to blue; 10 to 20 percent whites are produced in the second generation of crossing these two color phases. The whites produced in this manner will breed true, and when mated together always produce 100 percent white offspring. However, todate, all blues from litters containing any white animals have carried the white factor and produced a small percentage of white offspring when mated to animals of similar breeding. The mutation blue, characterized by a white blaze on its face, four white feet, small size and somewhat lighter pelt than the true blue fox, is also recessive to the blue. When this mutation is crossed with the white fox, the resulting offspring are blue in color and have a small, white blaze between their eyes and white tips on their toes. The second generation of such a cross vary in color from medium blue to white, and the whites carry the mutation factor.

The wild tundra mink are very late breeders. Although males are difficult to handle during the breeding season, limited experience indicates that this mink will produce well in captivity.

PROGRESS DURING THE YEAR: The breeding program with the blue, white and mutation blue foxes could not be carried out as planned, because of the small number of animals kept for breeding purposes and our inability to obtain several desirable matings. One of the most interesting litters produced was from a brother and sister mating of first generation white and mutation blue crosses. There were 12 pups in this litter: 3 whites (at least one of which carried the mutation factor) 5 very light, milky blue, and 4 light blues. Two other litters,

both white and mutation blue blood contained several of these very light animals. These pelts are quite attractive and would no doubt bring good prices if it were not for the existing low market.

In the mink program, only one of the wild tundra males bred. He mated one of the wild females and a hybrid pastel female. The other wild female was bred to a pastel male. The wild females each produced 5 kits (all females) and the hybrid pastel had 7 kits. This good production is contrary to that reported by breeders who have been trying to raise this type of mink in captivity the last year or two.

Only two marten litters of 3 and 4 kits respectively were produced this past year. Twelve female marten were bred during July and August. This was the best breeding season we have had for several years.

PUBLICATIONS: Limited to interagency reports.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-3-9(F)

PROJECT TITLE: The Effect of Different Levels of Manganese in the Diet of Hens and Pullets

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: William J. Sweetman and Fred Swingle

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: None

OBJECTIVE OF WORK: To determine if Alaska grown grains are inadequate in manganese for egg production

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Ten pens of pullets are now under study and will complete their laying period June 1, 1952.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Pullets raised on range do not show symptoms of manganese deficiency during a complete laying year. There is no difference in production or mortality between pens on Alaska grown grains without additional manganese and those with additional manganese.

PROGRESS DURING THE YEAR: Pullets raised on range and then put into the laying house do not show symptoms of manganese deficiency when fed on Alaska grown grains. Two pens of 30 pullets each received an all mash diet of Alaskan grown grains and 2 pens received the same diet plus 50 grams of manganese sulphate per 100 pounds of mash. The pens without the extra manganese produced 19.0 eggs per month per pullet. The two pens with extra manganese produced 17.8 eggs. There also was no significant difference in the egg shell weights.

PUBLICATIONS: None.

PROJECT NUMBER AND FUND: AL-1-3-10(P)

PROJECT TITLE: The Production Costs of Dairy Beef Steers raised on Minimum Grain and Maximum Use of Roughage and Pasture Under Alaskan Conditions

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: William J. Sweetman and Wallace Middleton

LOCATIONS: Matanuska Experiment Station

COOPERATION: Bureau of Dairy Industry

OBJECTIVE OF WORK: To determine the cost and best methods of raising dairy steers to $1\frac{1}{2}$ to 2 years of age under Alaskan conditions.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: All bull calves born in the Matanuska herd will be carried through a t least one winter under only the pole type shelter.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: It is possible to raise dairy steers to $1\frac{1}{2}$ to 2 years of age at a cost of $108 per steer while their value for meat will be about $200. Most of this cost accrues in the first 6 to 8 months. They will winter through on silage alone and make excellent gains from pasture the next summer.

PROGRESS DURING THE YEAR: Six steers (3 Grade Gurenseys and 3 Holstein Guernsey Crosses) were wintered through the winter of 1949-50 under a shelter made of poles with straw blown on the top and three sides. The south side was left open. These steers were fed all the stack silage they would eat from November 1 to June 1. No grain was fed throughout this time. On June 1 these steers were turned into a woods pasture, all of which was land unsuited for cultivation because of extreme slope.

The average age was $7\frac{1}{2}$ months on November 1, their average weight 397 pounds. The average weight on June 1 was 483 pounds. The average gain during the winter was only 0.41 pounds per day but otherwise they came through the winter in good shape. These steers had an average weight of 702 pounds on September 1, with an average daily gain on woods pasture of 2.38 pounds.

The total cost, without labor or pasture was $108 per steer including the first 6 months when they were raised as other dairy calves. The value of these steers dressed was just $200 per steer at the average age of 1 year and 7 months.

The winter of 1950-51 seven steers were handled in the same manner. Their average age on November 1 was 8 months 10 days, the weight 419 pounds. On June 1 their weight was 468 pounds. The average daily gain during the winter was 0.23 pounds. Their weight on September 1 was 587 pounds with an average daily gain on pasture of 1.29 pounds. The pasture season of 1951 was extremely dry so that pasture was not as plentiful as the year before which accounts for the lower gain in 1951 as compared with 1950.

PUBLICATIONS: None

WORK PROJECT NUMBER: AL-1-4

DIVISION: Alaska Agricultural Experiment Station

BUREAU OR AGENCY: Agricultural Research Administration

WORK PROJECT TITLE: Agricultural Engineering

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: C. Ivan Branton

LOCATION: Alaska Agricultural Experiment Station, Palmer, Alaska

COOPERATION: Horticulture (participated in potato top killing experiments); Animal Husbandry (participated in poultry ventilation studies); Agronomy (participated in cereal drying and storage investigatiohs); Agricultural Economics (participated in planning land clearing projects).

OBJECTIVE OF CURRENT WORK: The development of a stable agricultural economy in Alaska is contingent upon a great many factors; however, the following are important requirements involving the application of engineering principles to agriculture. A practical economical set of farmstead buildings. Extremes of weather present the problem of providing sufficient insulation for the agricultural purposes at a cost which an agricultural enterprise will support. This problem is under investigation under a project to develop methods utilizing local timber supplies for the construction of buildings which will be functional, furnishing adequate protection and yet economically sound. To avoid untimely replacement of buildings structural deterioration must be kept to a minimum by proper construction, ventilation and vapor sealing.

Alaskan agriculture is severely handicapped by lack of a cereal production program. Preliminary data indicates that adequate cereal grain production can only be developed when the artifical drying of grains is practiced. This problem is under investigation and if solved in an economically feasible manner should enable farmers in the Territory to produce their own cereal grains. This could result in the local production of mixed feeds keeping a large amount of money in the Territory which now goes into the payment of transportation. Cereal production might also permit the economical production of meat products and the expansion of the poultry industry on a profitable basis.

One of the principle agricultural enterprises in Alaska is potato production. Improvements in handling procedure and in storage may increase the economic returns to the farmer.

PROGRESS DURING THE YEAR:

Prelinimary uses of Native Lumber Observations on the experimental cabins of native materials would indicate that there are five combinations which are requiring less heat that the standard, which is constructed of finished imported materials. Spot checks of data also indicate that the application of a vapor seal on the warm side of the walls made of native material will save as much as twenty percent on the heat required.

Poultry House Ventilation Studies Tentative data based on a single year's observation in the Matanuska Valley indicates that egg production in a properly insulated, vapor-sealed, and ventilated poultry house may be just as high as where supplemental heat is added.

Potato Vine Killing Experiments to kill potato vines by chemical and phycical means have not yet resulted in sufficient data to make recommendations; however, the investigations are continuing.

Cereal Grain Drying and Storage In the 1950 season which was unusually dry during harvest season a few samples of barley were gathered which were sifficiently dry for good storage. The 1951 season was a wet season and no grain was found sufficiently dry for storage.

It was learned that 50 gallon drums are too small to react in a similar manner to farm grain bins, although well suited to a statistical analysis because of the ease of replication. Storage experiments are now being conducted in wooden bins of approximately 50 bushel capacity.

The entire grain crop at the Fairbanks experimental farm was dried in the column type drier. The circular bin drier was used at Matanuska, although it is still to be considered as an expedient, pending the receipt of funds for an adequate grain drier.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Data has been accumulated for one operating season; however, no publications have been written. There is a wider acceptance of the need for vapor sealing insulated structures, which may have resulted from the stressing of this factor by the agricultural engineer on extension and veterans adminestration instructional programs.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Comparative performance studies on the 13 buildings constructed for a study of native materials will be continued. Studies of poultry ventilation methods are to be continued at the Matanusks Station. It is planned to dry hay at both Fairbanks and Matanuska Station using supplemental heat and the centrifugal blowers. Feeding trials by the Animal Husbandry Department have been used to evaluate the results obtained. Cereal grain will be dried at both Matanuska and Fairbanks Stations. Storage studies will be continued to determine the effect of moisture content on germination and keeping quality of the cereal grains.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-4-1 (F)

PROJECT TITLE: Investigations to Develop Improved Structures, Equipment and Methods of Handling and Storing White Potatoes

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: C. Ivan Branton, M. F. Babb and C. H. Dearborn

LOCATION: Matanuska Experiment Station

COOPERATION: Horticulture Department

OBJECTIVE OF WORK: To reduce potato weight and quality losses from the field through storage and to reduce handling costs in field operations.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Major emphasis during the coming year will be placed upon the research to study the effect of killing vines to induce early maturity of tubers. It is hoped that a suitable treatment may reduce feathering of the tubers and eliminate some of the damage in digging. It is intended to use an additional mechanical method of vine killing during the coming season which will be similar to the action of the commercial beaters. Mechanical methods of vine removal previously used have been cutting and burning.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: The operations to date under this project have produced data indicating that certain chemicals useful for top killing but injurious to the tubers in other areas may not produce effects which would interfere with the sale of potatoes in Alaska. Vine nuisance can be economically minimized using top killing spray applied with weed killing equipment.

PROGRESS DURING THE YEAR: The physical examination of tubers from plots treated in the 1950 season showed that stem end browning was not a factor which would have adversly effected the saleability of tubers except in the case where the tops were killed by flaming. Also the tubers from plots sprayed with Aero-Cyanate (18 pounds per acre) and from plots where tops were cut showed significantly lower specific gravity than tubers from the check plots.

In the 1951 season 8 treatments using combinations of 5 different chemicals with 2 physical means were used upon replicated plot trials of a single potato variety. Chemicals used were: Premerge, sodium acetate, sodium chloracetate, sodium pentachlorophenate, aero cyanate, and Dow General. Although the data from the 1951 treatments has not yet been analyzed, casual observation indicates that there is a comparative small number of stained tubers compared to the 1950 crop. It is thought that the difference may be due to the type of season which was exceedingly dry in 1950 and unusually wet in 1951. A statistical analysis of the data will be made to evaluate the effects observed.

PUBLICATIONS: Interdepartmental reports

PROJECT NUMBER AND FUND: AL-1-4-3 (BJ)

PROJECT TITLE: Determination of the Insulation and Ventilation Requirements of Farm Structures and the Development of Improved Methods of their Construction Under Alaska Climatic Conditions.

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: C. Ivan Branton and W. J. Sweetman

LOCATION: Matanuska Experiment Station and Palmer laboratory

COOPERATION: Animal Husbandry Department

OBJECTIVE OF WORK: To develop economically feasible methods of construction, insulating, vapor sealing, and ventilating agricultural structures in Alaska, using native materials and labor supplies to the maximum extent possible.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Under this project two related but different investigations are underway. One phase consists of the investigation of methods of utilizing local lumber in building farm structures suitable to Alaska. During the coming season the taking of data will be continued on power consumption, temperature, and air resistance on 13 structures built with experimental wall sections of native material.

In connection with ventilation requirements for poultry houses, taking of data on four identical pens of laying hens will be continued. All pens are insulated and vapor sealed; however, two have supplemental heat and two do not.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Incomplete sampling of the data indicate that the use of vapor seal will save as much as 20 percent on the heat required as well as protect the structural members of a building. Spot checks of data also indicate that five of the experimental buildings using native materials are equaling the performance of the standard unit which is constructed of finished imported materials. Keeping the investment in a farmstead low through the proper use of cheaper but effective materials could mean the difference between success or failure. The importance of this factor is great because of a scarcity of capital in Alaska and the prevailing 8 percent interest rates.

PROGRESS DURING THE YEAR: Two lines of approach are discussed separately in the following sections.

Uses of Native Materials for Agricultural Buildings To obtain greater uniformity of temperature control, greenhouse type thermostats were installed in the experimental houses. Thermocouples, previously installed were connected to a recording potentiometer in order to obtain continuous and typical records. It was immediately observed that some cabins would not maintain the temperature called for on the thermostat during severe weather. An additional inner door was added to all cabins in an effort to cut down the effect of air leakage around the doors. Sawdust used for a fill insulation in all floors and ceilings was found to decrease in moisture percentage from 67% to 34% in the first seven months of operation.

Ventilation of Agricultural Structures Egg production in four insulated and vapor sealed experimental pens varied slightly with the highest production in a fan ventilated, unheated pen and lowest in a heated, natural ventilated pen. Production differences were not significant when the data were analyzed. The tentative indication is that supplemental heat is unnecessary in laying houses located in the Anchorage-Palmer area when insulated, vapor sealed, and equipped with proper arrangements for ventilation.

PUBLICATIONS: None

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-4-4 (F)

PROJECT TITLE: Cost of Land Clearing and Economic Utilization of Native Forest Products.

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: C. Ivan Branton and H. A. Johnson

LOCATION: Matanuska Experiment Station

COOPERATION: Agricultural Economics

OBJECTIVE OF WORK: To develop land clearing methods which may be adapted to Alaskan conditions of topography, soils, forest cover and agriculture use.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: It is not expected that work can be started on this project during the year since a considerable amount of operating money would be required to properly set up the project.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: No work has been done on the project to date.

PROGRESS DURING THE YEAR: The planned work was conceled because of priority placed on other projects.

PUBLICATIONS: None

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-4-5 (F)

PROJECT TITLE: Handling and Storing High Moisture Content Cereal Grain

PERIOD COVERED BY THE REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: C. Ivan Branton

LOCATIONS: Matanuska Experiment Station and Fairbanks Experiment Station

COOPERATION: Agronomy Department

OBJECTIVE OF WORK: To determine the most practical method of drying cereal grains in Alaska for feed and seed production and also to determine the optimum moisture content of grains for maximum retention of viability.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: The scope of this planned work has been reduced as a result of limitations on the overall budget. During the present year and for the coming crop season it is planned to limit storage studies to one grain, barley. Seven 50 bushel bins of barley of varying moisture contents were put in storage this season. Two types of chemical preservative were applied as well as untreated barley at twenty, eighteen and sixteen percent moisture. Germination tests and temperature records of the grain are being kept. Drying data will be kept for the operations at Fairbanks station with particular emphasis on determining labor and fuel costs for drying feed grains.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: The subject of grain drying has been discussed at Extension meetings; however, to date no literature has been published.

PROGRESS DURING THE YEAR: Three lines of approach were undertaken in 1951. The results are discussed under separate headings below.

Moisture Content of Cereal Grains as Harvested As a result of a very rainy fall there was much spoilage of grain which could have been avoided with adequate drying equipment. Some typical field moisture samplings are as follows (values are in terms of oven-dry weights)

Edda Barley:	23.8,	25.5,	18.1	21.0 percent
Gopher Oats:	18.2,	23.6,	20.5 percent	

None proved sufficently dry to keep without special precautions in handling.

Grain Drying Data Complete operating data including labor costs, heat requirements, air flow and temperatures were recorded in triplicate tests at the Fairbanks station using the column type batch drier. Operating data were obtained on both oats and wheat. These data have not yet been analyzed and evaluated.

Grain Storage Experiment Storage of grain in the 50 gallon steel drums did not prove successful as no samples spoiled regardless of how wet the grain was when stored. Temperature readings were regularly recorded and moisture determinations were periodically made. Experiments on grain storage this season are confined to a single grain, barley. Seven bins have been built which are approximately 3 1/2 feet square by 4 feet deep. Regular temperature readings are being taken using thermocouples located in the bins. With the larger bins, it is anticipated that some indication of the safe moisture content for storage may be obtained.

PUBLICATIONS: None

WORK PROJECT ANNUAL REPORT

WORK PROJECT NUMBER: AL-1-5

DIVISION: Alaska Agricultural Experiment Station

BUREAU OR AGENCY: Agricultural Research Administration

WORK PROJECT TITLE: Agricultural Economics

PERIOD COVERED BY THE REPORT: January 1, 1951 to December 31, 1951

SUPERVISORY LEADER: Hugh A. Johnson

LOCATION: Palmer, Alaska

COOPERATION: Informal cooperation with other departments of the Station and with other government agencies.

OBJECTIVE OF CURRENT WORK: To analyze the relationships of production practices to the enterprise costs and returns of farming in Alaska and to provide information to farmers interested in improving their farming conditions; also to analyze the present and potential market for products of Alaska's farms that present products may be fully utilized and that future production may be geared to the market needs of the period.

PROGRESS DURING THE YEAR: Farm management records of 1950 farm operations taken during the winter of 1950-51 were analyzed and a report was written (AL-1-5-1). A survey of consumer preferences for food items Alaska can produce and the quantities of these foods purchased was made during the summer of 1951. Preliminary analysis of the collected data were made. Further monthly information is being gathered by mailed questionaire (AL-1-5-2). A study of marketing practices being followed in isolated agricultural aresa of western Canada was made during the summer and a report was prepared (AL-1-5-3).

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: The analysis of 1950 farm management records has illustrated the rapid flux in Alaskan agriculture. The survey provides a measure of yearly change on commercial farms, but it must be continued for several years before benchmarks will be established from which "norms" might be calculated. The enterprise analysis work is useful in helping farmers plan their operations for greatest efficiency. The marketing research orientation continues to be toward defining and describing the potential market for local products. The 1951 survey provides information on the buying habits of urban housewives to which should be oriented the future marketing practices of farmers and their marketing agents. A separate survey of marketing methods being used in western Canada provided further background and guidance for desirable changes in the farmer's marketing practices. We also prepare periodic press releases covering changes in prices of 44 grocery items in several Alaskan cities and relate these to changes in the cost of living in the United States. Two completed reports were made and analysis of the third project was carried as far as possible with the data at hand. The farm management report summarized management data available to date and will be published as a bulletin. The report on Canadian marketing practices was dittoed, bound in a fairly firm paper cover and transmitted to agricultural workers responsible for encouraging farmers to improve their marketing methods.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Farm cost

and return analysis will be continued on a reduced scale because of reduced funds and a smaller staff. Emphasis will be on continuing the series begun in 1950 with commercial dairy and poultry farmers. When funds become available later, the analysis of minor enterprises will be picked up again and farm management studies expanded to cover growing agricultural areas. Most work in farm management will be restricted to the Matanuska Valley in 1952 unless it should become necessary to perform some cooperative work in the Tanana Valley related to S.C.S and Bureau of Land Management surveys for the Chena Withdrawal (AL-1-5-1). Marketing research probably will be restricted to completing several phases of the consumer survey begun in 1951 and continuing the cost of living service work. Availability of funds and personnel after July 1 will control the detail and volume of work that can be accomplished (AL-1-5-2). As soon as funds and personnel are available, it is highly essential that we conduct studies in land economics, relating the historical settlement pattern to soil types, transportation systems, etc, as guides to future settlement programs and policies. Some of this work may be accomplished in the Tanana Valley this summer under a cooperative arrangement. It should be done soon in other areas to take advantage of unrecorded information in the minds of a few remaining old settlers. This kind of information will not be available much longer.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-5-1(F)

PROJECT TITLE: Basic Economic Study of Farm Management and Production in Middle Alaska
PERIOD COVERED BE THIS REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: Hugh A. Johnson and Clarence A. Moore

LOCATION: Palmer, Alaska

COOPERATION: Informal Cooperation with other departments of the station and with other government agencies.

OBJECTIVE OF WORK: To assemble and analyze farm management and production data essential to more effective use of resources on established farms and to the sound guidance of settlement and development of new agricultural areas in Alaska.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMMING YEAR: Due to a reduction in the Economics staff, the farm management survey must be curtailed. Instead of expanding our information to the new farmers developing on the Kenai Peninsula, around Anchorage and in the Tanana Valley, and the continued study of minor enterprises in the Matanuska Valley, our survey in 1952 will be limited to commercial dairy and potato farms. In thes way we will lose the least in continuity of statistical information for the project. The three years of records already at hand prove by their variation that several more years of records will be required before important factors not associated with weather and climate can be isolated.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: The Data gathered and analyzed in 1951 re-emphasizes that Alaskan agriculture is in a state of flux. Dairying still is increasing in the Matanuska Valley. In 1949, the net returns from potato farms averages $5,669 and was $1,060 greater than the average for commercial dairies. In 1950, however, the position was reversed and dairy farms averaged a net income of $5,482 compared to $4,152 for potato farms. The improves status of dairymen occured because of increased benefits from specilization and greater efficiency. The potato enterprise declined in over-all importance on potato farms, and prices failed to rise proportionately to expenses, in 1950. Poultry farm returns failed to rise with rising expenses in 1950. This largely accounts for the poorer showing of poultry farms in 1950 compared to those of 1949.

PROGRESS DURING THE YEAR: Calendar 1951 was spent in taking records of farm enterprises on 79 Matanuska Valley and 18 Tanana Valley farms, in analyzing the data and preparing the report. A manuscript was submitted for publication at the end of the year.

PUBLICATIONS: A mimeograph report, "Alaska Farms Organization and Practices in 1949" was processed and distributed early in 1951. A manuscript "Farming in the Matanuska and Tanana Valleys in 1950" was prepared for printing.

PROJECT NUMBER AND FUND: AL-1-5-3(R)

PROJECT TITLE: Marketing Problems of Isolated Agricultural Communities

PERIOD COVERED BY THE REPORT: June 1, 1951 to January 31, 1952

SUPERVISORY LEADER: Hugh A. Johnson

LOCATION: Palmer, Alaska

COOPERATION: Informal cooperation with other departments of the station and with other government agencies in Alaska. Assistance from Provincial and Dominion officials in Canada.

OBJECTIVE OF WORK: To study effective and proven methods of reducing collection, processing and distribution costs common to small agricultural communities located at some distance from markets.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: This project is being closed January 31 because of lack of funds and personnel.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: This project was designed to compare successful Canadian marketing methods in isolated areas with marketing methods and conditions in Alaska. It is being dropped for lack of funds and the Alaska portion of the survey will not be made.
The Canadian portion of the study indicated that their farm marketing organizations in isolated communities generally follow some of the following practices:

1. They generally prefer that perishable vegetables be marketed by the individual grower.
2. They prefer to handle storables that need not move into consumption channels immediately.
3. They prefer to limit the number of varieties to a bare minimum.
4. They try to encourage uniform cultural practices.
5. They want the crop harvested when it is of market size and market quality.
6. They have adequate storage facilities on farms or at the warehouse.
7. They make producers responsible for grade.
8. They get the best managers available to run the business.
9. They pay wages sufficent to get and keep competent help.
10. They keep the help busy by shifting even the specialists throughout the organization during slack seasons. They do much of their repairing, remodeling, and storage of inventories with regular help recruited from other departments.
11. They keep their overhead and handling charges low.

PROGRESS DURING THE YEAR: A trip was made to western Canada and their marketing systems were studied. A report was prepared for use by various persons responsible for marketing programs and procedures in Alaska.

PUBLICATIONS: A 29-page dittoed report "Notes on Marketing Perishables From Fringe Areas of Western Canada, 1951" was prepared and limited distribution was made to specialists and individuals interested in the field of marketing. The report was not for general distribution.

WORK PROJECT NUMBER: AL-1-6

DIVISION: Alaska Agricultural Experiment Station, Don L. Irwin, Director

BUREAU OR AGENCY: Agricultural Research Administration

WORK PROJECT TITLE: Field Crops Investigations

PERIOD COVERED: January 1 to December 31, 1951

SUPERVISORY LEADER: H. J. Hodgson

LOCATIONS: Matanuska and Fairbanks Stations, Research Laboratory at Palmer, and various locations in areas of agricultural potential in Alaska.

COOPERATION: Animal Husbandry Department (on pasture and feed processing studies); Agricultural Engineering Department (on feed processing studies); Soil Conservation Service, On-the-Farm Training Program, and Extension Service (on uniform cereal and forage nurseries throughout agricultural areas of Alaska); Bureau of Plant Industry, Soils and Agricultural Engineering; and various state agricultural experiment stations.

OBJECTIVES OF CURRENT WORK: (1) To develop varieties of forage crops which are more winterhardy, higher yielding, and otherwise agronomically acceptable and to establish foundation seed supplies; to test introduced forage species and strains for adaptability to Alaskan environments; (2) to develop varieties of cereal crops for Alaska with earlier maturity, higher yields, disease resistance, and resistance to lodging, and to establish foundation seed supplies; to test all available introductions for production and/or value as breeding material; (3) to determine optimum cultural practices for forage and cereal crops with regard to yield, maturity, winter survival, and nutritive value of forage or grain; to test various grass-legume associations for hay and pasture; (4) to develop a system of weed control in field crops for Alaska; (5) to evaluate native and cultivated grasses and legumes under various grazing and management systems and to determine the most satisfactory means of increasing pasture yields; (6) to determine the relative efficiency of preservation, cost of preservation, and nutritive value of forage crops preserved as field cured hay, barn dried hay, and silage.

PROGRESS DURING THE YEAR: Forage Investigations: AL-1-6-11: Approximately 350 selected plants of yellow and purple flowered alfalfa (Medicago falcata and M. sativa, respectively) are now under study. Their combining ability for hardiness, seed and forage yield, resistance to disease, and resistance to seed shattering is being evaluated in various progeny tests. Eleven introduced varieties of M. sativa were seeded in a simulated grazing test at 2 locations. Space planted nurseries of about 2,800 plants of segregating populations from M. falcata X M. sativa crosses and creeping rooted alfalfa were established. No survival was obtained with 14 sweetclover varieties seeded in 1950. New sweetclover trials were seeded in 1951. Eight red clover varieties were seeded in drilled and broadcast stands. Yields up to 2.8 tons dry matter per acre were obtained from drilled plots. Of 26 alsike clover varieties seeded in 1950, none survived the first winter. Twelve bromegrass varieties in broadcast plantings averaged 3.4 tons dry matter per acre and did not differ significantly. Bromegrass and timothy breeding nurseries were established and a broadcast timothy strain trial was seeded. Bromegrass, meadow foxtail, timothy, and Kentucky bluegrass were outstanding in the Uniform Alaska Forage Nurseries. No legume gave satisfactory performance in this test except in a few locations. AL-1-6-12: New grass-legume mixture tests were established. An oat-pea mixture of 33 and and 67 pounds per acre respectively, and the harvest made when oats were in the

milk stage and lower pea pods were well filled gave greatest yields of all mixtures and time of harvest compared. Protein analyses are being made on all combinations of seeding mixtures and harvest dates. A bromegrass seed production experiment was established comparing methods of planting, dates of clipping in the fall previous to seed production, and rates of nitrogen fertilization. A study was begun to determine the effects of freezing, oven drying, and air drying on germination of seeds of various forage species harvested at various intervals following fertilization. AL-1-6-6: Pasture renovation will increase yields for a period of about 2 years. Best practices should combine fertilization, especially with nitrogen, with an occasional renovation. AL-1-6-7: The relative efficiencies of dry matter in bromegrass harvested as field cured hay, barn dried hay, and silage were 100, 113.9, and 144.3, respectively. Oats-and-peas showed the same general trend.

Cereal Investigations: AL-1-6-3: Approximately 120 barley, 100 oat, 30 wheat, and 10 flax varieties were grown in rod row tests at the Matanuska and Fairbanks Stations. Preliminary evaluations of 400 oat and 120 wheat varieties were also made. Edda barley and Golden Rain oats continued to perform well. They were released to growers in the spring of 1951. The much-needed earliness in wheat was not found in any variety tested though several selections from crosses of Khogot with other varieties are about as early as Khogot and show promise with respect to seed quality and lodging resistance. Flax yields were good, one variety averaging about 29 bushels per acre. Edda barley and Golden Rain oats were outstanding at 17 locations of the Uniform Alaska Cereal Variety Trials. Plans were developed for a Uniform Alcan Cereal Test to be conducted in cooperation with several Canadian provinces. Tests conducted by the U. S. Barley and Malt Laboratory at Madison, Wisconsin, revealed that malts and beers brewed from Edda barley are satisfactory. Rutin production by Tartary buckwheat is high, but possibilities of commercial production are questionable. AL-1-6-5: Greatest yield responses resulted from the addition of nitrogen, only small increases resulting from addition of phosphorous and potash. Early May plantings resulted in greatest yields of recommended cereal varieties. Seeding rates of 1½ bushels, 2 bushels, and 3 bushels per acre for wheat, barley, and oats, respectively resulted in greatest yields. Five pounds of chlordane and 1/2 pound of lindane per acre were most effective in controlling wireworms in cereal crops. AL-1-6-10: The 444 most promising entries selected from the World Collection of Barley in 1950 were grown at 2 locations and 170 were selected for further evaluation. The World Collection of Oats, numbering 3,875 varieties, was grown in single 4-foot rows and about 320 entries were saved for further study. The World Collection of Flax, numbering 668, was grown in single 4-foot rows about 75 being selected for further study.

Weed Control: AL-1-6-9: Preliminary evidence indicates that some herbicides may be of value as pre-emergency sprays for forage crops. Of 10 post-emergence sprays used, 15 pounds per acre of Aero Cyanate gave almost complete control of chickweed, but was effective only slightly on lamb's-quarters. Dinitro at 3 quarts per acre gave partial control of both chickweed and lamb's-quarters. Sodium Trichloracetate 90% (TCA) at rates of 50 pounds per acre or more applied after plowing and disking gave complete control of quackgrass. Dinitro and Aero Cyanate were very effective in cereal crops without causing injury to the cereals. The isopropyl ester of 2,4-D at 1/2 pound per acre satisfactorily controlled lamb's-quarters but injured peas and higher rates severely damaged cereals.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: This work project has contributed to Alaska Experiment Station Circular 13 (Rev.), Fertilizers for Alaska, 1952; Circular 15, Golden Rain Oats for Alaska; Circular 16, Edda Barley for Alaska. Golden Rain oats and Edda barley were released to seed growers in 1951. The adoption of recommended

forage preservation practices and better pasture fertilization has resulted in a substantial increase in milk production per cow in the Matanuska Valley.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Special emphasis will be placed on further evaluation of selected varieties from the World Barley and Oat Collections, and the continued search for earlier maturity in wheat (AL-1-6-3); investigations on rates and dates of planting of cereals, and fertilizer requirements of cereals (AL-1-6-5); comparing fertilization and renovation of bromegrass pastures (AL-1-6-6); selective control of weeds in forage and cereal crops by pre- and post-emergence sprays, and control of quackgrass (AL-1-6-9); growing the World Collection of Wheat if seed is available (AL-1-6-10); selection of superior phenotypes of alfalfa (Medicago falcata and M. sativa), bromegrass, red clover, and timothy; progeny testing of selected plants; evaluation of strains of several species introduced from Europe and the States (AL-1-6-11); evaluation of grass-legume mixtures; bromegrass and alfalfa seed production; fertilizer requirements of forage crops; dates of harvest and their effect on yield and nutritive value of herbage; effect of nurse crops on stands and winter survival of legumes; rates and dates of seeding legumes (AL-1-6-12).

PROJECT NUMBER AND FUND: AL-1-6-3(H) (Rev. July 1, 1950)

PROJECT TITLE: Cereal Crop Breeding

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: S. C. Litzenberger

LOCATIONS: Matanuska and Fairbanks Stations, Research Laboratory at Palmer, and/or other locations which may be defined later.

COOPERATION: Bureau of Plant Industry, Soils and Agricultural Engineering (Division of Cereal Crops and Diseases) and other state, Federal, and Territorial agencies

OBJECTIVE OF WORK: To develop and release to growers in Alaska improved varieties of cereal crops, these crops having been improved by breeding.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Crosses of Vicland, Cherokee, and Eaton with Golden Rain and Climax oats were made at the Matanuska Station in 1951 and the F_1 plants were grown at Beltsville, Maryland, during the winter season. The F_2 generation will be grown in a space planted nursery at the Matanuska Station. Selection will be aimed at isolating an oat variety possessing a combination of yielding ability, early maturity, stiffness of straw, and smut resistance more favorable than any of the parental strains. The most promising varieties of barley selected from the World Barley Collection grown under project AL-1-6-10 will be tested in preliminary yield trials at the Matanuska and Fairbanks Stations in comparison with standard barley varieties.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Seed of Edda barley and Golden Rain oats was released to Alaska farmers for planting in 1951. Both represent a more desirable combination of yield, maturity, lodging resistance, and quality factors than varieties previously recommended for growing in Alaska.

PROGRESS DURING THE YEAR: Approximately 120 barley, 100 oat, 30 wheat, and 10 flax varieties were grown in rod row tests at the Fairbanks and Matanuska Stations. In addition, preliminary evaluation of about 400 oat and 120 wheat varieties was carried out in single row plots at the Matanuska Station. Average yields of oats and barley were somewhat below 1950 yields at the Matanuska Station, while average yields at the Fairbanks Station were similar to 1950 yields. Edda barley continued to perform well, averaging 57.8 and 43.9 bushels per acre at the Matanuska and Fairbanks Stations, respectively. Edda was the highest yielding variety at the Matanuska Station, but was exceeded in yield by several later varieties at the Fairbanks Station. The newly released Golden Rain oat variety yielded 58.6 and 76.0 bushels per acre at the Matanuska and Fairbanks Station, respectively. Late varieties exceeded these yields at both Stations. None of the wheats tested possessed the much-needed earliness. Several selections from crosses of Khogot with other varieties were about as early as Khogot, and showed promising improvement over Khogot in regard to lodging resistance and seed quality. Flax yields were promising, a new entry, Multiple Cross, yielding 29.3 and 28.6 bushels per acre at the Matanuska and Fairbanks Stations, respectively.

The Uniform Alaska Cereal Variety Trials were grown at 17 locations in Alaska this season. Four varieties each of barley, wheat, and oats and a single rye variety were included in the test. Yields were obtained from 16 of the 17 locations. Edda barley was outstanding in performance, outyielding the other barley varieties in all except one location. Golden Rain oats continued to perform well in these tests. Khogot wheat was exceeded in grain yield at most locations this year by the later maturing Victory. Results of these tests have been furnished all cooperators.

Planning was completed for a Uniform Alcan Cereal Test to be conducted in cooperation with several nearby Canadian Provinces. Plantings are to begin with the 1952 season. Four locations in Canada and 3 in Alaska are currently planned, plantings to be similar in size to the Uniform Alaska Cereal Variety Trials.

Complete chemical analyses are being made on grain samples from 4 locations of the Uniform Alaska Cereal Variety Trials, but the results are not yet available. Results of previous years indicate that the varieties recommended for growing in Alaska are at least of equal feeding value in comparison with varieties grown in the United States. Malting and brewing tests were conducted with Edda barley grown at 3 locations, the Matanuska and Fairbanks Stations in Alaska, and Bozeman, Montana. Preliminary results indicate that while small differences exist among the beers brewed, all were considered very acceptable. Rutin analysis were made on Tartary buckwheat in cooperation with the Soils Department. When grown in Alaska, vegetative development of this variety is great and rutin content is high. Commercial possibilities of growing buckwheat for rutin in Alaska are questionable due to the high cost of commercial extraction equipment and the present uncertainty of its widespread use as a medicinal drug.

PUBLICATIONS: Litzenberger, S. C. and B. M. Bensin, "Golden Rain Oats for Alaska," Circular 15. 1951.

Litzenberger, S. C. and B. M. Bensin, "Edda Barley for Alaska," Circular 16. 1951.

PROJECT NUMBER AND FUND: AL-1-6-5(P) (Rev. July 1, 1950)

PROJECT TITLE: Cereal Crop Culture

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: S. C. Litzenberger

LOCATIONS: Matanuska and Fairbanks Stations and/or any other locations which may be defined later

COOPERATION: Bureau of Plant Industry, Soils and Agricultural Engineering (Division of Cereal Crops and Diseases) and other state, Federal, and Territorial agencies

OBJECTIVE OF WORK: To determine the optimum method of culturing recommended cereal crop varieties under Alaskan conditions including methods of seeding, rate and date of seeding, fertilizing, or any other cultural practice that appears worthy of investigation.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Rate and date of planting experiments will be continued with recommended varieties. Fertilizer experiments will be expanded in cooperation with the Soils Department to check on possible interactions in the effects of the different fertilizer elements. Chemical control measures for wireworms will be further investigated in cooperation with the Entomology Department.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Investigations under this project have aided the formulation of the current fertilizer recommendations for cereals. Early planting of cereals at a high rate of seeding has been shown to result in increased grain yields.

PROGRESS DURING THE YEAR: Edda barley, Golden Rain oats, and Khogot wheat were tested with 18 different combinations of nitrogen, phosphorous, and potash fertilizers. Plantings were at 4 locations, on old and new clearings in the Matanuska Valley and on upland and bottomland soils at the Fairbanks Station. The greatest yield response resulted from addition of nitrogen, only small increases in yield were apparent with addition of phosphorous or potash. The greatest percentage increase resulted from addition of 30 pounds of nitrogen per acre on newly cleared land, where yields of the 3 varieties averaged 200 percent greater than the check.

Two date-of-planting experiments were conducted at the Matanuska Station and 1 at the Fairbanks Station. Edda barley, Golden Rain oats, and Khogot wheat were the varieties tested. Best results were obtained with plantings made in early May.

Three rates of planting were tested at the Matanuska and Fairbanks Stations. Consistently higher yields were obtained at the highest rates of seeding used, 1½ bushels, 2 bushels, and 3 bushels per acre for Khogot wheat, Edda barley, and Golden Rain oats, respectively.

In cooperation with the Entomology Department 7 insecticides were tested for control of wireworms in plantings of barley, wheat, and oats at the Matanuska Station. Treatments were applied and worked into the soil prior to planting. Five pounds of Chlordan and 1/2 pound of Lindane per acre were the most effective treatments. Ethylene dibromide was noted to have a toxic effect on the cereal crops.

PUBLICATIONS: Contributed to Circular 13, "Fertilizers for Alaska, 1952".

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PROJECT NUMBER AND FUND: AL-1-6-6(F)

PROJECT TITLE: Pasture and Range Improvement and Management

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: H. J. Hodgson and W. J. Sweetman

LOCATIONS: Matanuska and Fairbanks Stations

COOPERATION: Agronomy and Animal Husbandry Departments; Bureau of Plant Industry, Soils and Agricultural Engineering (Division of Forage Crops and Diseases); Bureau of Animal Industry; Bureau of Dairy Industry; Department of Interior (Grazing Service); and other Territorial and Federal agencies.

OBJECTIVE OF WORK: To determine the yield of native range, cultivated pastures (annual and perennial) under different grazing and management systems, and their effect on maintenance of stands of grasses and legumes in the Matanuska and Tanana Valleys; to determine the effects of different methods of grazing management on nutritive value of forage, milk production of dairy cows or beef production of beef cattle; to measure the comparative feed production in the form of hay, grains, and pasture; to determine the possibilities of establishing pastures on lands of limited crop value; to determine the value of renovation and reseeding permanent pasture sod to increase yields.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Renovation experiments will be continued at the Fairbanks Station. As a result of consistent failure of legume stands during the first winter, emphasis at the Matanuska Station will be shifted to improvement of pastures through fertilization.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Renovation has been found to increase pasture yields even though legume stands winterkill during the first year. Thorough disking and reseeding appear to overcome the sod bound condition for a period of 2-3 years.

PROGRESS DURING THE YEAR: In the Matanuska renovation experiment, no new seedings were made in 1951. Yields in terms of standard cow days per acre for the check, first, second, and third year following renovation were 31, 22, 46, and 35, respectively. Yields in third year declined to about equal the check while in the second year yields were about 50 percent greater as was the case in 1950. The low yield of the first year after renovation probably was a result of extremely dry weather in the year of renovation and in the spring of the first year following renovation. At Fairbanks where the renovated pastures are on a droughty hillside, renovation has shown no increase in pasture yields.

PUBLICATIONS: None

PROJECT NUMBER AND FUND: AL-1-6-7(P)

PROJECT TITLE: Feed Production, Processing and Preservation

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: H. J. Hodgson, W. J. Sweetman, and C. I. Branton

LOCATIONS: Matanuska and Fairbanks Stations

COOPERATION: Agronomy, Animal Husbandry, and Agricultural Engineering Departments; Bureau of Dairy Industry; Bureau of Plant Industry, Soils and Agricultural Engineering (Division of Forage Crops and Diseases)

OBJECTIVE OF WORK: To determine the relative efficiency of preservation, cost of preservation, and feeding value for forages (grasses and legumes) preserved as (1) field cured hay, (2) barn dried hay, and (3) silage.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Emphasis will be placed on comparisons between barn dried hay and silage made from various forage crops with respect to costs of harvesting and preservation and the nutritional value of the forage as determined by feeding trials and chemical analyses.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Research to date has shown conclusively that field cured hay is the most expensive of the 3 methods of harvesting and preserving forages and in addition results in the lowest quality feed. Barn dried hay has been intermediate in quality of roughage and about as expensive as field cured hay, while silage has been the highest in quality and the cheapest to harvest and store. From a survey of dairy farmer records in the Matanuska Valley, it has been shown that average milk production per cow has risen from 7,200 pounds in 1947 to 8,300 pounds in 1950. This closely parallels the increased use of forages for silage.

PROGRESS DURING THE YEAR: At the Matanuska and Fairbanks Stations oats-and-peas and second-crop bromegrass were processed as barn dried hay and silage. Data from feeding trials with this material is not yet complete and will be reported in the 1952 report. In 1949 and 1950 second-crop bromegrass was harvested in the 3 methods listed under "Objectives". The pertinent data (see table, next page) show that a pound of dry matter in silage on the average is about 44 percent more efficient than a pound of dry matter in field cured hay; the value of barn dried hay being intermediate. Average costs per ton of dry matter were: field cured hay, $28.43, barn dried hay, $28.56, silage, $18.05, and average dry matter losses from cutting to storage were 41.1, 28.6, and 21.0 percent for field cured hay, barn dried hay, and silage, respectively. Reduced costs, lower dry matter losses, and a higher quality feed result from utilization of forages as silage.

Oats-and-peas harvested as barn dried hay and silage in 1950 were fed to dairy cows in advanced stages of lactation. This resulted in relatively low yields of milk, but dry matter in silage was 13 percent more efficient than dry matter in barn dried hay.

PUBLICATIONS: None

Comparative feeding value of second-crop bromegrass harvested as field cured hay, barn dried hay, and silage in 1949 and 1950 at the Matanuska Station.

Items compared	1949			1950			Average		
	Field cured hay	Barn dried hay	Silage	Field cured hay	Barn dried hay	Silage	Field cured hay	Barn dried hay	Silage
Milk/lb. TDN in roughage (lb.). . . .	1.54	1.72	1.86	1.30	1.50	1.81	1.41	1.61	1.84
Milk/lb. dry matter in roughage (lb.). . . .	0.85	0.96	1.13	0.72	0.83	1.16	0.79	0.90	1.14
Comparative efficiency of dry matter . . .	100	112.9	132.9	100	115.3	161.1	100	113.9	144.3
Milk/acre (lb.) . . .	1676	1835	1995	780	1212	1647	1228	1524	1821

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PROJECT NUMBER AND FUND: AL-1-6-9(F)

PROJECT TITLE: Weed Control

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: H. J. Hodgson, S. C. Litzenberger, and C. I. Branton

LOCATIONS: Matanuska and Fairbanks Stations

COOPERATION: Bureau of Plant Industry, Soils and Agricultural Engineering (Division of Weed Investigations)

OBJECTIVE: To develop a system of controlling annual and perennial noxious weeds on Alaska farms.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Investigations will be continued on the control of weeds in forage and cereal crops with pre- and post-emergence sprays of 2,4-D, Aero Cyanate, Dinitro, and other herbicides applied at various rates and dates. In addition, TCA and IPC will be evaluated further for control of quackgrass and wild barley, and their residual effects will be studied.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: It has been demonstrated that commercially available herbicides can be satisfactorily used to control chickweed and lamb's-quarters in cereal crops in Alaska. Preliminary evidence indicates that the same will be true for grass and legume seedings. TCA at rates of 50 pounds per acre or more has effectively controlled quackgrass.

PROGRESS DURING THE YEAR: Eight herbicides were used in pre-emergence sprays on 8 forage species. Aside from IPC which eliminated grass stands, no herbicide seriously reduced stands of the forage species. IPC (at 2½ pounds per acre) in fuel oil almost completely eliminated chickweed (Stellaria media) and black bindweed (Polygonum convolvulus). Premerge and Dow General reduced stands of lamb's-quarters (Chenopodium album) to a slight degree. Of post-emergence sprays applied to forage species in seedling stages, Aero Cyanate at 15 pounds per acre and Dinitro at 3 quarts per acre were quite effective in selectively controlling chickweed and lamb's quarters. Practically no injury to legumes and grasses occurred. Dow Formula 40, the 8-ounce rate of the sodium salt of 2,4-D, and MCP were effective in controlling shepherd's purse (Capsella Bursa-pastoris) and spurrey (Spergula arvensis), but also caused severe injury to legumes.

Sodium Trichloracetate 90% (TCA) at rates of 50 pounds per acre or more applied following plowing and discing gave complete control of quackgrass (Agropyron repens). Rye was successfully established in the fall on TCA treated plots.

Three rates of each of 3 formulations of 2,4-D, Dinitro at 1 gallon per acre, and Aero Cyanate at 15 pounds per acre were evaluated for controlling weeds in Khogot wheat, Edda barley, and an oat-pea mixture. The isopropyl ester of 2,4-D at 1/2 pound per acre effectively controlled lamb's-quarters in all plantings, but caused injury to peas and higher rates of this formulation damaged cereals. Dinitro was also very effective except in wheat where a droughty condition reduced its effectiveness. Aero Cyanate was very effective on chickweed in all trials, but it gave poor control of lamb's-quarters. No injury to crop plants was caused by Aero Cyanate.

PUBLICATIONS: Press release on control of quackgrass with TCA.

PROJECT NUMBER AND FUND: AL-1-6-10(H)

PROJECT TITLE: Evaluate United States Introduced and Developed Strains of Cereal Crops for Adaptation to Subarctic Conditions

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: S. C. Litzenberger

LOCATION: Matanuska and Fairbanks Stations and/or any other location which may be defined later

COOPERATION: Bureau of Plant Industry, Soils and Agricultural Engineering (Division of Cereal Crops and Diseases and Division of Plant Exploration and Introduction) and other state, Federal, and Territorial agencies

OBJECTIVE OF WORK: To thoroughly evaluate all available strains of cereal crop varieties when grown under subarctic conditions for growth habit, date headed, date ripe, plant height, yield of grain and straw, seed quality, stiffness of straw, reaction to prevailing diseases, and other characteristics which may have an influence on the adaptation or use of these varieties for experimental or commercial purposes.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: If seed is available, the World Collection of Wheat will be grown in single rows at the Matanuska Experiment Station near Palmer. Promising entries previously selected from the World Collections of Barley, Oats, and Flax will be grown at the Matanuska and Fairbanks Stations for further evaluation and comparison with standard varieties.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: There has been no direct contribution to public benefit arising from this work to date. Varieties have been selected that show promise as adapted varieties and as breeding material, but further evaluation is necessary.

PROGRESS DURING THE YEAR: The 444 most promising entries selected from the World Collection of Barley in 1950 were grown in single rows at the Fairbanks and Matanuska Stations and on the Frank Mullen farm near Soldotna. On the basis of agronomic notes taken during the growing season, approximately 170 promising varieties were selected for further evaluation. The World Collection of Oats, consisting of 3,875 varieties, was grown in single 4-foot rows at the Matanuska Station. Approximately 320 entries were retained for further study. The World Collection of Flax, numbering 668, was grown in single 4-foot rows at the Matanuska Station. Of these, approximately 75 were considered promising enough to save for further evaluation. The World Collections of Oats and Flax were made available through the Division of Cereal Crops and Diseases and the Division of Plant Exploration and Introduction.

PUBLICATIONS: None

PROJECT NUMBER AND FUND: AL-1-6-11(A)

PROJECT TITLE: Forage Crop Breeding

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: H. J. Hodgson and William B. Wilder

LOCATIONS: Matanuska and Fairbanks Stations

COOPERATION: University of Alaska Extension Service; Bureau of Plant Industry, Soils and Agricultural Engineering (Division of Forage Crops and Diseases); Soil Conservation Service; and other agencies

OBJECTIVE: To develop through introduction, hybridization, and selection superior varieties of native and introduced grasses and legumes (alfalfa, red, alsike, white and sweet clover, smooth bromegrass, timothy, and others that may be of economic value) for production of forage and seed and for special uses under Alaskan environmental conditions, and to produce foundation seed of these varieties for release to farmers; to conduct cytogenetic investigations on native and introduced grasses and legumes.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: This project supercedes projects AL-1-6-1(A) (Alfalfa Breeding), AL-1-6-2(F) (Bromegrass Breeding), and AL-1-6-4(T) (Adaptation Studies on Native and Introduced Grasses and Legumes) effective July 1, 1951. It embraces the work previously performed under these projects and is broadened to include all research on breeding of forage crops.

Major alfalfa work will consist of (1) continuing the testing of open pollinated progenies of selected plants of Medicago falcata and M. sativa, (2) selection of desirable types of surviving plants from segretating populations from M. sativa X M. falcata hybrids, (3) continuing the testing of introduced varieties of M. sativa, (4) selection of desirable phenotypes of both species, (5) investigations of cytogenetics of M. falcata and hybrids with M. sativa, and (6) seed increase of M. falcata.

Testing of introduced varieties of smooth bromegrass (Bromus inermis), timothy (Phleum pratense), red clover (Trifolium pratense), sweetclover (Melilotus species), and other forage species will be continued. Selections will be made from breeding nurseries of most of the above mentioned species. An effort will be made to secure from the Scandinavian countries as wide a range of germplasm as possible of the forage species of importance in Alaska.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: This work has not progressed to the point where improved varieties are available though [illegible] forage strains are now under preliminary seed increase. Information is being gained which will permit making recommendations as to which of the currently commercially available varieties should be used until the breeding programs result in improved varieties.

PROGRESS DURING THE YEAR: Alfalfa - The alfalfa variety trial established in 1949 winterkilled the first winter except for Grimm and M. falcata. The former winterkilled during the second winter while the latter survived in a perfect stand. Three open pollinated progeny tests were seeded in 1951 to (1) evaluate the combining ability for hardiness and forage yield of 64 plants of M. sativa which are descendents of a number of Ladak plants which had survived several winters at Fairbanks, (2) evaluate the combining ability for hardiness and

forage yield of 42 selected clones of M. falcata, and (3) evaluate the combining ability for seed yield of 81 selected clones of M. falcata. These evaluations will furnish part of the data necessary for determining which of the selected clones should be combined into synthetic varieties. Additional plant selections of M. falcata were made in 1951, raising the number of individual plants under study to about 250 and this number will no doubt be increased in future years. About 100 selected plants of M. sativa are now being evaluated at Fairbanks. Open pollinated seed of these plants was harvested this year and will be used for progeny testing in future years since the value of any plant can be determined only by studying its progeny. Seed yields ranged from 0 to 62 grams per plant; maturity dates ranged from August 28 to October 3; extreme variability was noted in resistance to seed shattering, growth habit, vigor, leafiness, seed size and color, and other characters; and, while most plants have a high percentage of hard seeds, there appears to be sufficient variability to enable progress to be made in selection for a relatively low hard seed percentage. Hard seeds and the difficulty of achieving satisfactory scarification probably are largely responsible for the difficulty experienced in securing adequate stands.

Eleven alfalfa varieties were seeded at each Station and are being tested under a clipping schedule to simulate grazing conditions. Similar tests are being conducted in many states. Ladak and Ranger were considered best on the basis of the first season's production.

Approximately 2,200 space planted plants were established consisting of backcross and F_2 generations from M. falcata X M. sativa crosses. Many pollinations were made in the greenhouse in producing more backcross and F_2 generation seed. In addition, about 600 plants were established from seed of creeping rooted selections from Swift Current, Saskatchewan, Canada.

Various species of bumble-bees (Bombus sp.) were the chief pollinators of yellow flowered alfalfa in Alaska though other wild bees were present and undoubtedly acted as pollinators to a limited extent.

The most important disease noted on alfalfa was black stem (Aschochyta imperfecta). Snow mold (Fusarium species) was noted at Fairbanks and bacterial wilt (Corynebacterium insidiosum) was found, for the first time in Alaska, in an old stand of M. falcata at the Matanuska Station. So far as is known, bacterial wilt heretofore has never been reported this far north.

Sweetclover - No survival was observed on any of the sweetclover varieties seeded in drilled plots at the Matanuska Station in 1950. New trials of a similar nature were seeded at Matanuska and Fairbanks in 1951. Dry weather resulted in very poor stands at the former location and cutworm damage was extensive at Fairbanks. It has been shown, however, in the past 3 seasons, that sweetclover, when drilled in rows and cultivated, will produce very satisfactory yields of silage, but that when so managed no winter survival is experienced. In 1951 5 biennial strains were seeded broadcast in a nurse crop of Olli barley. Good stands were obtained and plants became well established before killing frosts. Winter survival will be evaluated in 1952 and if possible yields will be taken. It is thought that this type of management might alter the physiology of the plant enough to keep it in a vegetative state of growth, thus favoring storage of root reserves. When planted without a nurse crop, the plant enters a reproductive stage of growth at an early age under the long Alaskan photoperiod.

Red Clover - Eight varieties were compared in the 2 types of management discussed for sweetclover. Under drilled conditions all varieties flowered, but mammoth types were much later than medium red clovers. Yields were taken at half bloom stage and at the end of the growing season. Altaswede, a mammoth type, yielded 2.5 tons of dry matter per acre at half bloom stage; all others yielded

significantly less. At the end of the growing season Altaswede, Manhardy, and Dollard all yielded about 2.8 tons of dry matter per acre. Protein analyses will be made on all varieties for both harvest dates to determine the effect of stage of maturity on nutritional value of the forage. In the broadcast planting in a nurse crop of Olli barley excellent stands were obtained and, following removal of the mature nurse crop in early August, the clovers produced a growth up to 22 inches. The medium red clovers were tallest and flowered while the mammoth strains grew to a height of only 12 inches and did not flower. Winter survival and yields will be noted in 1952. A space planted nursery of an Alaskan strain, commonly referred to as Siberian or Russian red clover, revealed extreme variability. Notes were taken on individual plants and selections will be made in 1952 from plants that survive the winter. It is believed this strain can be markedly improved by selection.

Alsike Clover - None of the 26 alsike clover strains introduced from Finland, Sweden, Germany, Russia, Turkey, and Australia seeded in 5-foot rows in 1950 survived the first winter. A small seed increase block was established of one alsike clover strain which previously has exhibited some hardiness.

Bromegrass - Twelve varieties comprising the Uniform North Central Bromegrass Nursery seeded at Matanuska in 1950 were harvested twice during 1951. No significant differences were present on the basis of the total season's production, the 12 varieties averaging 3.4 tons dry matter per acre. All varieties appeared to survive the first winter 100 percent. Northern strains seemed to have a more rapid recovery after cutting, though this was not reflected in second cutting yields. A space planted breeding nursery was established in 1951. Seedlings of about 15 named varieties and advanced generations of Bromus inermis X B. pumpellianus hybrids were started in the greenhouse and transplanted to the field nursery.

Timothy - A space planted breeding nursery was established in a manner similar to the bromegrass nursery. Ten varieties and a collection of seed from old plants at Fairbanks were used as source material. Each plant was rated for vigor, leafiness, and leaf position. The highest proportion of superior plants was found in the Fairbanks Collection with 2 Norwegian strains ranking next. A broadcast strain trial was also seeded, but poor germination resulted in unsatisfactory stands for most varieties.

Uniform Forage Nurseries - The uniform forage nurseries established in 1950 in cooperation with the Veterans On-the-Farm Training Program, Soil Conservation Service, and the Agricultural Extension Service were continued. Whereas reed canarygrass and alsike clover appeared outstanding the first season, they almost completely winterkilled in most nurseries. Especially outstanding during this season were bromegrass, meadow foxtail, timothy, and Kentucky bluegrass. In most nurseries no legume survived save M. falcata which was always present, but generally in poor stands.

PUBLICATIONS: None

PROJECT NUMBER AND FUND: AL-1-6-12(P)

PROJECT TITLE: Forage Crop Production

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADERS: H. J. Hodgson, William B. Wilder, and John E. Osguthorpe

LOCATIONS: Matanuska and Fairbanks Stations

COOPERATION: University of Alaska; Bureau of Plant Industry, Soils and Agricultural Engineering (Division of Forage Crops and Diseases); various state, Federal, and Territorial agencies

OBJECTIVE OF WORK: To determine the cultural practices most conducive to securing high yields of high quality forage and seed of the species recommended for use in Alaska including annual cereals and legumes used for forage.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: This project supercedes AL-1-6-8(F) (Grass-Legume Mixtures) as of July 1, 1951, and embraces the work carried on thereunder. It is broadened to include all phases of forage crop production. The following will be emphasized in 1952: grass-legume associations, seed production of forages, rates and dates of seeding and times of harvesting, effects of management on the hardening-off of legumes as measured by conductivity tests and winter survival, the nutritional requirements of forage crops, and effects of management practices on nutritional value of the herbage.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: There are indications that legumes may be better able to survive winters if seeded in a nurse crop, provided a high stubble is left for winter protection. Any practice that can be shown to favor survival of legumes would be of great value.

PROGRESS DURING THE YEAR: Grass-Legume Mixtures: All legumes and all grasses except bromegrass, Kentucky bluegrass, and meadow foxtail, seeded in the grass-legume mixture test in 1949, winterkilled almost completely in the second winter. The surviving grasses will be clipped in future years to simulate pasture management. Two new grass-legume mixture tests were seeded in the spring of 1951, but cutworm injury and the dry spring resulted in uneven stands. The Fairbanks test was reseeded in midsummer while the Matanuska test will be reseeded in 1952.

Rate of Seeding and Date of Harvest Study on Oat-Pea Mixtures: Five oat-pea mixtures and 5 dates of harvest were tested in all possible combinations. The mixture consisting of 67 and 33 pounds per acre of peas and oats respectively produced the highest yields. The harvest made when the lower pea pods were well filled and the oats were in the milk stage produced yields as high as later dates of harvest. Chemical analyses are being made to determine the effects of treatments on nutritional value of the herbage.

Seed Production: An experiment was seeded comparing the effects of method of seeding (rows vs. broadcast), date of last cutting in fall, and various levels of nitrogen applied in spring on production of seed of smooth bromegrass. Seed yields will be taken in 1952.

An experiment was begun to determine the stages of maturity that various forage species could be harvested for seed. Seed harvested at each stage of maturity were subjected to the following treatments: (1) freezing at 26-28° F for 2 hours, (2) drying at room temperature, and (3) artificial drying at 100° F. Germinations are being made on all treatment combinations.

PUBLICATIONS: None

WORK PROJECT NUMBER: AL-1-7

DIVISION: Alaska Agricultural Experiment Station

BUREAU OR AGENCY: Agricultural Research Administration

WORK PROJECT TITLE: Entomological Investigations

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: Richard H. Washburn

LOCATIONS: Palmer and Fairbanks, Alaska

COOPERATION: Soil Science Department (fertilizer), Agronomy Department (labor and land preparation), Horticulture Department (plant materials and labor), Bureau of Entomology and Plant Quarantine (insect identification).

OBJECTIVE OF WORK: To develop insect control measures that will be effective in facilitating crop, livestock and poultry production under Alaskan conditions; work out the biology of Alaskan insect species; continue list of Alaskan insects; conduct investigations in insect pollination of crop plants and biological control measures of injurious insects.

PROGRESS DURING THE YEAR: Root Maggots AL-1-7-1(A): Studies on biology control experiments, resistance variety studies in turnips, radishes and rutabagas, wild host plant studies and extent of maggot activity through the Territory. Cutworm Investigations AL-1-7-2(F): Studies on biology, control and parasitism. Effect of Soil Treatment on Soil Biota and Future Plant Growth AL-1-7-3(F): Effect of insecticides on several crop plants grown in Alaska and effect on soil inhabiting insects and microorganisms. Wirewirms AL-1-7-5(F): Studies on biology and control experiments.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Procedures have been worked out which make possible the production of maggot free turnips and radishes and probably excellent control of root maggots in cabbage, broccoli and cauliflower. Additional materials have been found which are very effective in controlling cutworms. Several insecticides have been found which effectively control wireworms in grain.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Root maggot biology and control will be further investigated in the Matanuska and Tanana Valleys. Further attention will be given to crop varieties apparently somewhat resistant to maggot attack, AL-1-7-1(A). Cutworm biology and control will be further investigated, AL-1-7-2(F). Effect of soil treatments on plant growth and soil biota in the Matanuska Valley will be further examined, AL-1-7-3(F). Wireworm biology and control will be further investigated, AL-1-7-5(F).

PROJECT NUMBER AND FUND: AL-1-7-1(A)

PROJECT TITLE: Root Maggots

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: Richard H. Washburn

LOCATIONS: Matanuska and Fairbanks Experiment Stations

COOPERATION: Soil Science Department (fertilizer), Agronomy Department (land preparation), Horticulture Department (plant material and labor), Bureau of Entomology and Plant Quarantine (insect identification)

OBJECTIVE OF WORK: To investigate the root maggot incidence, wild host plants, dissemination and crop plant damage under various environmental conditions in field and controlled conditions to determine an effective means of control for turnip, seed corn and onion maggots

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Major emphasis during the coming year will be placed on continuing biological studies of root maggots, further development of control procedures, and further testing of resistant plant varieties.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Aldrin, dieldrin, chlordan, heptachlor and dilan have given maggot free turnips in 7 applications at 10 day intervals of 1 pound active ingredient per application. This should greatly reduce production costs of cole crops as without treatment 50 - 95 percent of turnips are culls.

PROGRESS DURING THE YEAR: Treatments with aldrin, dieldrin, dilan and heptachlor consisting of 4 applications at 10 day intervals, 1 pound active ingredient per application, have given 95 percent control of root maggots in white egg turnips. Furrow treatments of radishes with aldrin, heptachlor and dieldrin appeared promising in the Matanuska Valley. Sixteen varieties of radishes, 22 varieties of turnips and 7 varieties of rutabagas were planted at the Matanuska Station and in cooperation with Horticulture Department at Fairbanks Experiment Station, and checked for maggot resistance. Several varieties appear worthy of further testing. Maggot surveys indicated usual widespread activity from Kenai Peninsula to the Yukon River in all areas checked. Near Homer a high degree of infestation was found in first plantings on newly cleared land. Onion maggots were again found in sets but not in green onions from seed.

PUBLICATIONS: Interdepartmental and interagency reports (informal).

PROJECT NUMBER AND FUND: AL-1-7-2(F)

PROJECT TITLE: Cutworm Investigations

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: Richard H. Washburn

LOCATIONS: Matanuska and Tanana Valleys

COOPERATION: Horticulture Department (labor), Agronomy Department (labor), Bureau of Entomology and Plant Quarantine (insect identification)

OBJECTIVE OF WORK: To find an efficient means of control for the several species of cutworms important in the Matanuska Valley.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Collection and rearing of larvae, collection of parasites, comparison of insecticides applied by different methods

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Aldrin, chlordan and heptachlor have been found to be very effective in control of cutworms at rates of 1 pound per acre, per application. Chlordan has been accepted by the growers of this area for cutworm control.

PROGRESS DURING THE YEAR: Aldrin, chlordan and heptachlor have been found to be especially effective in controlling cutworms when applied in emulsion form at the rate of 1 pound per acre. The number of applications necessary is dependent upon age and size of larvae. Effectiveness was greatest on moist soil and least under very dry conditions. Of 211 cutworm larvae collected and reared 54 emerged as adults, 11 hymenopterous parasites emerged and the remainder died from disease or other causes. Identification has not been completed so it is not known if the adults represent any additional species. The 1951 season was more serious than 1950 in the Matanuska Valley. In the Tanana Valley the home gardens were seriously infested the first time in several years and many were forced to replant their gardens. Some injury occurred on the Kenai Peninsula. Chitina had no cutworm damage in 1951 and reported that 1949 was the only year in which any cutworm feeding had ever been noted. It is hoped that with the new greenhouse facilities it will be possible to conduct insect life history studies in a more satisfactory manner.

PUBLICATIONS: Interdepartmental and interagency reports (informal).

PROJECT NUMBER AND FUND: AL-1-7-3(F)

PROJECT TITLE: Effect of Soil Treatment on Soil Biota and Future Plant Growth

PERIOD COVERED BY REPORT: January 1 to December 31, 1951

SUPERVISORY LEADER: Richard H. Washburn

LOCATION: Matanuska Experiment Station

COOPERATION: Soil Science Department (fertilizer) Horticulture Department (labor)

OBJECTIVE OF WORK: To derermine long range effect of soil insecticides on plant growth and soil organisms under Alaskan conditions

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Major emphasis during the coming year will be placed on futher testing of plant materials and continuing the soil examination for insects and micro-organisms.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS FO THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Soil treatments of no immediate effects on the growth of oats, bromegrass, radishes and turnips at the time of treatment and the first year following. Growth of soil organisms on soil agar dilution plates were apparently unaffected with exception of the plot treated with lindane.

PROGRESS DURING THE YEAR: No effect on the growth from grass, oats, turnips and radishes in second season treatment at 25 pounds per acre active ingredient of several organic insecticides. Light maggot infestations in parathion, aldrin and dieldrin plots compared to heavy maggot enfestation in DDT, methoxychlor and check plots.

PUBLICATIONS: None.

PROJECT NUMBER AND FUND: AL-1-7-5(F)

PROJECT TITLE: Wireworm Investigations

PERIOD COVERED BY REPORT: March 27 to December 31, 1951

SUPERVISORY LEADER: Richard H. Washburn

LOCATIONS: Matanuska and Tanana Valleys

COOPERATION: Agronomy Department (land, plant material and labor), Bureau of Entomology and Plant Quarantine (insect identification)

OBJECTIVE OF WORK: To determine the species, life history and distribution in relation to soil type, and the control of Alaskan wireworms by cultural and chemical methods

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Emphasis in the coming year will be placed on further collections, biological and control studies.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: Several materials including aldrin, chlordan and lindane have been found to give excellent control of wireworms in grain and offer an easy method of control for grain crops.

PROGRESS DURING THE YEAR: Barley appears to be more susceptible to wireworm injury than either oats or wheat. In cooperative experiments with Agronomy Department at the Matanuska Experiment Station, lindane, dieldrin, aldrin, ethylene dibromide, and chlordan have been found to give good control of wireworms in grain. Wireworm damage in potatoes is apparently confined to limited though widely distributed localities in much of Alaska. Crop rotation or entire avoidance of infested fields for potatoes is probably the simplest and cheapest solution. In some areas in the Matanuska Valley seed pieces are invariably riddled while the tubers are only slightly damaged. In preliminary experiments in the Matanuska Valley in wireworm infested potato field on sandy soil, no injured tubers were found in the area treated with aldrin, dieldrin, chlordan or heptachlor. An early freeze ended digging before all the desired information was obtained. Several additional wireworm species were collected. Adult flight period for the Matanuska wireworm appears to be mid-June. Rearing attempts were unsuccessful.

PUBLICATIONS: Interdepartmental and interagency reports (informal).

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

WORK PROJECT NUMBER: AL-1-8

DIVISION: Alaska Agricultural Experiment Station

BUREAU OR AGENCY: Agricultural Research Administration

WORK PROJECT TITLE: Plant Pathology Investigations

PERIOD COVERED BY THE REPORT: March 17 to December 31, 1951

SUPERVISORY LEADER: Donald M. Coe

LOCATIONS: Palmer and Fairbanks, Alaska

COOPERATION: Agronomy, Horticulture and Entomology Departments; Division of Mycology and Plant Disease Survey, BPISAE

OBJECTIVE OF WORK: To investigate the more important diseases affecting the major economic crops grown in Alaska and their relationships to native plants and soil and climatic factors with the objective of developing methods for their control.

PROGRESS DURING THE YEAR: Survey of Economic Diseases AL-1-8-1(P): Systematic collection and identification of plant diseases has been started and a permanent herbarium established. The Use of Fungicides in Plant Disease Control AL-1-8-2(P): Preliminary studies in the use of fungicides were limited by unavailability of materials. Trials were started on the chemical control of lettuce anthracnose. Materials for future use have been assembled. Pathology of Winterkilling of Forage Crops AL-1-8-3(P): The presence of bacterial wilt in yellow flowered alfalfa (Medicago falcata) was discovered for the first time in Alaska.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: A more complete picture of the incidence and losses caused by ring rot of potatoes has been secured. A permanent herbarium of plant disease specimens has been established. Fungicidal materials have been gathered for systematic study of their use under Alaskan conditions.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Herbarium development will be intensified. Studies in the spread of virus diseases of potatoes under natural conditions are under way. Fungicidal application will be investigated in both laboratory and field studies.

Cooperative efforts with the Extension Service and other organizations will be made to alleviate ring rot in the potato situation.

PROJECT NUMBER AND FUND: AL-1-8-1 (P)

PROJECT TITLE: Survey of Economic Crop Diseases

PERIOD COVERED BY REPORT: March 17 to December 31, 1951

SUPERVISORY LEADER: Donald M. Coe

LOCATION: Throughout agricultural sections of Alaska

COOPERATION: Horticulture and Agronomy Departments; Division of Mycology and Plant Disease Survey, BPIS & AE, University of Alaska Extension Service and Territorial Department of Agriculture

OBJECTIVE OF WORK: To investigate the identity, distribution and relative importance of diseases of the economic and related crop plants of Alaska

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Increased emphasis will be placed on diagnosis, by indexing methods, of the virus diseases affecting potatoes and the distribution of ring rot in Alaska potato stocks. Herbarium development will be pursued, emphasizing a more systematic method of collection.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: A survey of existing potato stocks shows none which can safely be presumed to be free from ring rot. On this basis, tuber units of desirable stocks have been selected and started through a program of developing disease-free potato seed stocks.

PROGRESS DURING THE YEAR: The herbarium, started in the fall of 1951, now holds over 50 verified specimens of parasitic plant diseases which are available for reference and comparisons. Lots of potatoes with various disorders have been collected for indexing for virus content according to standard methods.

PUBLICATIONS: None.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-8-2(P)

PROJECT TITLE: The Use of Fungicides for the Control of Plant Diseases

PERIOD COVERED BY REPORT: March 17 to December 31, 1951

SUPERVISORY LEADER: Donold M. Coe

LOCATION: Matanuska Experiment Station

COOPERATION: Entomology Department (duster and diluents), Horticulture Department (seed) and local farmers (lettuce field)

OBJECTIVE OF WORK: To test the efficiency of various fungicides and their methods of application in the control of plant diseases under Alaska conditions.

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Newly developed fungicides of a soil fumigating nature will be used in attempts to control potato scab. Damping-off will be studied in greenhouse trials with new fungicides at both Fairbanks and Matanuska. Trials of fungicidal dusts for the control of lettuce anthracnose will be carried on as seasonal development of the disease permits.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: The short time this project has been active has been insufficient for any conclusive results.

PROGRESS DURING THE YEAR: Four fungicidal dusts were applied in three applications for the control of lettuce anthracnose on a farm near Palmer. A period of warm weather checked the development of the disease at the period of head formation and at harvest there was no more disease in the untreated plots than in those to which fungicides had been applied.

Five fungicides were applied in four replications to tomato and pea seed for the control of damping off. The treated seed was planted in the greenhouse (unheated) but the early advent of cold weather stopped further growth before the seedlings could emerge.

PUBLICATIONS: None.

ALASKA AGRICULTURAL EXPERIMENT STATION
ANNUAL PROGRESS REPORT, FEDERAL AND FEDERAL-GRANT PROJECTS, 1951

PROJECT NUMBER AND FUND: AL-1-8-3(P)

PROJECT TITLE: Pathology of Winterkilling of Forage Crops

PERIOD COVERED BY REPORT: March 17 to December 31, 1951

SUPERVISORY LEADER: Donald M. Coe

LOCATION: Matanuska and Fairbanks Experiment Station

COOPERATION: Agronomy Department

OBJECTIVE OF WORK: To determine the identity, distribution, parasitic relationship and ecological factors in the plant parasitic organisms operative in the winterkilling complex in forage crops

LINES OF WORK TO RECEIVE SPECIAL ATTENTION DURING THE COMING YEAR: Major effort during the coming year will be on the ecological and cultural factors influencing incidence of winterkilling in forage crops.

TELL BRIEFLY 1 OR MORE IMPORTANT CONTRIBUTIONS SUCH AS PUBLIC BENEFITS OF THE PAST 3 YEARS WHICH JUSTIFY CONTINUED SUPPORT OF THIS WORK: This project has not been active long enough for any benefits to accrue.

PROGRESS DURING THE YEAR: Two species of Fusarium have been isolated from snow molded alfalfa plants at Fairbanks. The bacterial wilt organism (Corynebacterium insidiosum) was isolated from plants of yellow flowered alfalfa (Medicago falcata) showing typical symptoms and growing at the Matanuska Experiment Station.

PUBLICATIONS: None.

The foregoing pages present in considerable detail the research done at the Alaska Experiment Station in 1951, and have outlined technical plans for the coming crop year. Not mentioned in these administrative reports are numerous details connected with acquiring and maintaining physical facilities and equipment, and other housekeeping tasks that pose an ever-present obstacle to successful research. In older organizations where patterns of 50 or 100 years provide precedents, policies, and organizational experience, these details are part of the institution itself and are taken much for granted.

Here in Alaska this experience exists only in rudimentary form. Housekeeping problems are aggravated by the fact that all technical staff members have been transplanted from milder, less strenous climates. Their accomplishments in Alaska are the more commendable since any progress at all is made in spite of a rigorous, environment that affords but little security and few of the amenities of academic life. Although many difficulties of housing and of procuring technical facilities have been faced and overcome or circumvented, each new approach poses seemingly insurmountable obstacles that have been and will continue to be attacked with aggressive ingenuity.

This section of the annual report briefly presents some changes that occurred during the reporting period, lists few necessities and problems that remain for further consideration, and summarizes some administrative data (with particular reference to an embroyonic nutritional department) that was not included in the foregoing project reports.

Personnel and Organization

With the appointment of Dr. Donald Coe as plant pathologist on March 10, the nucleus of a plant pathology department was established, making a total of eight research departments in the present organization. On April 1, William B. Wilder was appointed assistant agronomist at the Fairbanks Station replacing Dr. Basil M. Bensin who retired on February 28; Dr. S. C. Litzenberger transferred from the Agronomy department on November 28 to accept a position with the Office of Foreign Agricultural Relations, being replaced by Roscoe L. Taylor as assistant agronomist at Palmer on December 9. In the Horticulture department Bobby L. Wilson accepted an appointment as assistant at the Fairbanks Station on March 26. A temporary addition to the Economics staff was John J. Mechling who served as an assistant from May 27 to October 26.

Wallace R. Middleton resigned as assistant animal husbandman on August 24; on October 6, Clarence A. Moore resigned as assistant agricultural economist. Neither of these research vacancies have yet been filled and in all probability they will remain vacant until some degree of budgetry security is attained. Remaining unfilled for the same reason are the positions of editor-librarian, a vacancy created by the resignation of Lucille Kennedy Mick on June 1, and of superintendent of the Matanuska Experiment Station, left vacant by the resignation of Lucius Ross on August 17. The duties of these last two positions have been departmentalized and assigned to technical personnel, somewhat to the deteriment of their research accomplishments.

On May 15, Carter Sherman resigned as foreman of the Fairbanks Station and was replaced by Eldon G. Osguthorpe. Arvo Kallio was designated superintendent (in addition to his other duties as horticulturist) temporarily replacing John Osguthorpe who left in September on a 6-month leave of absence to attend graduate school. In the administrative staff, Bonnie J. Bettine resigned on September 7, the payroll clerk position being filled by the appointment of Helen Riley.

The Physical Plant

In the course of conducting research in the facilities acquired from the university as well as those more recently erected under federal specifications certain deficiencies of design and exceptional weathering problems, resulting from extreme environment conditions, have become apparent. Water supply and waste disposal also pose special conditions as the maximum use of the physical plant is approached. The following notes mention some constructive accomplishments in overcoming many handicaps. A major part of these comments, however, deal with repair and maintenance, so long neglected in many of the older structures. New equipment requirements are the result of an attempt to minimize hand labor which poses an ever-increasing difficulty in this region of scarce manpower and high costs.

Progress during the year At the Matanuska Station a rapidly expanding research program plus unseasonable harvest weather and a total lack of work space forced temporary occupancy of a portion of the new horticulture and agronomy laboratory building before construction was completed. Numerous delays by the contractor and sub-contractors hampered progress on this building to the point that it was not ready for acceptance at the end of the reporting period although work had been in progress for some 18 months. A septic tank (4' x 4' x 10') was completed to handle sewage from this new building, which is discharged into a concrete block cesspool (10' x 14'), both being covered by reinforced poured concrete slabs; this disposal system also handles waste water from the milkhouse. It is hoped that the entire project will be ready for formal acceptance before midsummer 1952.

The interior of the milkhouse, gutted by fire in December 1951, was rehabilitated. Heat is supplied by an oil-burner which temporarily replaces the only vertical boiler which caused the fire. A wooden conduit carrying water and steam pipes from the building mentioned above has been installed. Use of steam from this large boiler will replace the oil-burner. That portion of the milkhouse formerly occupied by the forage drier is now used as a locker room. Also connected to the recently installed steam boiler is a remodelled hay drier in the adjacent barn mow. A major portion of this year's fall-cut hay was force dried in this mow, despite the fact that it contained large quantities of snow and free water. A 1,000-bushel grain bin equipped for drying grain last year was successfully used for drying experimental forage samples, thus serving as a temporary substitute for the old forage drier destroyed in the milkhouse fire.

Some progress was made constructing graveled service roads and suitable hard-standing on the station grounds. Excavated areas were immediately reseeded in order to restore the turf.

At the Fairbanks Station a new 5-inch well was driven to a depth of 102 feet. This new water source alleviates a serious and hazardous shortage for both domestic and fire prevention needs. Work on the new concrete garage and shop continued, necessary sawdust insulation being installed and electrical wiring for 3-phase power being completed. An abandoned root cellar under the barn was rehabilitated to furnish storage space for 2000 bushels of grain successfully produced and dried this year. One building serving as modest living quarters

At the Fairbanks Station the family living quarters, especially the two socalled apartment buildings located on low ground, need fundamental repairs. These were barracks buildings, acquired from military sources and moved to their present location shortly after the war. Unfortunately the site problems were not fully appreciated and concrete footings installed at that time have since proved extremely susceptible to frost damage. In some places these footings have heaved as much as 8 inches, in others they have settled so that floors, walls, cabinets and interior finishing are warping and cracking. An 8-inch sawdust insulating wall has not proved efficacious in halting these differential movements; a possible contributing factor in uneven subsidence of a permafrost table under the buildings, a frequently encountered problem in this region. Water heaters for summer supply are needed in these buildings. Roofs are in need of immediate replacement.

Grounds and service roads about the farmstead need rehabilitating in order to reduce drainage and erosion problems and to expedite spring work now hampered by mud.

To supplement the new well and to provide fire protection, a 30,000 gallon storage reservoir is required together with a suitable main, hydrant and hose system. As at the Matanuska Station, the present sewer is now inadequate; a new disposal system is imperative in order to restore sanitary conditions. An office building, greenhouse and machine shed must again be listed among the necessary requirements.

At the Petersburg Fur Station a 50- to 100-pen mink house is needed if fur investigations are to be continued; the present marten pens have outlived their usefulness and must be replaced. The new garage and storage shed needs painting and some of the plumbing must be renovated.

At Palmer the most urgent requirements are for a headhouse for the still uncompleted greenhouse range and refrigeration and heating to provide temperature control in the new experimental vegetable storage building. The grounds require grading, seeding and landscaping not only to improve their appearance but to reduce a very real dust nuisance and erosion hazard.

Maintenance of the physical plant has always been handled on an emergency basis, supervised by the station superintendents. The inavoidable vacancy at the Matanuska Station now places unduly heavy responsibilities on the Animal Husbandry and Agricultural Engineering departments which should be eased to facilitate research. In view of the high replacement values of physical facilities at Fairbanks, Matanuska, Palmer, and Petersburg it now appears desirable and necessary to set aside an annual maintenance fund. It is thought that supervision of repair and maintenance might well be assigned to an assistant agricultural engineer, a specialist in farm structures. This specialist would occupy a half-time research and half-time administration position and be delegated the responsibility for repair and mainetnance at all four stations.

Chemical Analysis

To furnish a quality index for feed and forage improvement studies it has been considered necessary to estimate the crude protein content of forages and feeds. This is accomplished by means of a routine chemical procedure which determines nitrogen content, protein being derived by multiplying by a well established factor. In accomplishing these service analysis, 2,056 nitrogen determinations were made during the reporting period.

was insulated and repaired so that it is now at least servicable. Work continued on fencing and on resurfacing service roads and hardstanding for equipment. A much needed fill, together with surface grading around several living quarters, is expected to reduce the mosquito nuisance and contribute to the farmstead's appearance.

At Petersburg, the old well was repaired by relining with concrete. The seven-stall garage and storage shed was completed but remains unpainted. Work was also continued on modernizing the dwelling.

At Palmer the new greenhouse facilities were nearing completion at the end of the year, after nearly 14 months under construction. The new experimental cold storage building was finished, excluding the refrigeration units which will be obtained under a separate contract. A rough grade was extablished around staff houses and seeded to turf in order to minimize wind erosion and a severe dust nuisance.

Future Requirements As previously mentioned, some reorganization is considered necessary in order to streamline maintenance and associated housekeeping problems. Delegation of the responsibility for care of the complete physical plant to a specialist in farm structures who might be able to devote half time to research problems is thought to offer a satisfactory solution to this problem.

At the Matanuska Station maximum use of all facilities have stretched the output of the present well to its limit. A new well should be dug and an additional pumping unit put in service to keep the reservoir full. A 4-inch main now connects the reservoir with two hydrants; in addition, a portable fire pump is needed to provide adequate fire protection. A permanently connected fire pump for the new garage and barn is under consideration. The greatest fire hazard now prevails in the barn area where a single set of buildings comprises dairy barn, hay barn, bull barn, garage, and feed and vegetable storage. The milkhouse and sheep barn are so close to the main buildings that a fire would probably destroy the entire layout. All buildings should be re-wired where necessary to minimize fire hazards.

The dairy barn needs to be checked for soundness of structural members; it also requires insulating, vapor sealing and ventilating. It is a frame building with no insulation in walls or ceiling; ventilation intake flues come in at the side, and discharge at the ceiling in the center providing ideal conditions for condendation. Incorporation of a heat exchanger in the ventilation system might prove advantageous. Sections of the concrete wall on north side of barn are being thrust inward by frost action; a new reinforced poured concrete wall will probably be required the entire length of the barn. A new silo is needed to provide additional feed storage, and the lower structure members of the present silos are decomposed to the extent of needing replacement this year. A grain elevator and a motor driven grinder would more than pay for themselves in labor savings, especially if the animal husbandry program is expanded. Additional labor and mechinery savings would result from the acquisition of a forage elevator to handle green hay. A heifer shed to provide 800 square feet of shed area is also needed.

Two housing units are badly in need of paint and roof repairs at the Matanuska Station. Cesspools constructed when these quarters were first built have served their useful purpose; they should be replaced with septic tanks and disposal pits in order to eliminate offensive odors and restore sanitary conditions.

Considerable interest ha recently developed in the crude rutin content of Alaska grown buckwheat; it is based on evidence that plants grown in the Matanuska Valley contained relatively large quantities of this pharmaceutical material, now in short supply because of increasing medicinal demands. It therefore appeared desirable to analyze representative buckwheat samples in order to estimate the feasibility of further developing and encouraging rutin production as a cash crop. During the reporting period 21 rutin determinations were made.

Publications

An important feature of research work in Alaska is the dissemenation of results that have immediate and practical application. This phase of the work has received continued emphasis during the reporting period. A list of formal publications and press releases appearing or in preparation during 1951 follows:

Bulletins

McCurdy, R. E. & H. A. Johnson Agricultural possibilities of Alaska's Kenai Peninsula Bulletin 13

Moore, C. A. Farming in the Matanuska and Tanana valleys of Alaska Bulletin 14 (now at the printers)

Circulars

Coe, D. M. Tuber units for better seed potatoes Mimeographed Circular 2

Hodgson, H. J., S. C. Litzenberger, B. M. Bensin, & J. E. Osguthorpe Recommended varieties of field crops for Alaska, 1951 Circular 14

Litsenberger, S. C. & B. M. Bensin Golden Rain oats for Alaska Circular 15

Litzenberger, S. C. & B. M. Bensin Edda barley for Alaska Circular 16

Mick, A. H., H. J. Hodgson, & S. C. Litzenberger General recommendations: Fertilizers for Alaska Circular 13

Morre, C. A. Alaska Farms: Organization and practices in 1949 mimeographed Circular 1

Sweetman, W. J., W. R. Middleton & F. Swingle Raising dairy calves and heifers in Alaska Circular 17

Journal Articles

Hodgson, H. J. & A. H. Mick Farming in Alaska Crops and Soils (submitted)

Litzenberger, S. C. Reaction of cereal varieties to smuts in Alaska The Plant Disease Reporter 35:482-484 1951

Irwin, D. L. Science in Alaska's agriculture Science November 1951

Johnson, H. A. The role of agricultural economics in Alaska 2nd Alaska Science Conference, AAAS September 1951

Mick, A. H. Soil research in Alaska 2nd Alaska Science Conference, AAAS September 1951

Sweetman, W. J. Livestock in Alaska 2nd Alaska Science Conference, AAAS September 1951

Interim Report

Johnson, H. A. (processed) Marketing perishables from fringe areas of western Canada November 1951

Popular Articles

Coe, D. M. Potatoe storage The Alaskan Agriculturist Submitted in September

Litzenberger, S. C. Edda, a new barley for Alaska The Alaskan Agriculturist

Litzenberger, S. C. Golden Rain oats for Alaska The Alaskan Agriculturist

Annual Reports

12th Annual Progress Report, 1947
13th Annual Progress Report, 1948 (now at the printers)
14th Annual Progress Report, 1949
15th Annual Progress Report, 1950 (in preparation)

Press Releases

Time to Buy Fertilizer . . .	January	Cost of Living Survey	June
Edda Barley	March	Results of Variety Trials	November
Golden Rain Oats	April	T C A Controls Quackgrass	November
Fertilize Your Pasture Now . .	May	Cost of Living Survey . .	December

INDEX TO ALASKA WORK AND LINE PROJECTS

The following lists shows a departmental breakdown of line projects and also shows the staff responsibilities for general supervision of each work project. Initials after the index number indicates which fund is used for the major support of each project, according to the following code:

(A) Adams (P) Purnell (T) Territorial
(H) Hatch (F) Federal (R) Research and marketing

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